

Appendix C for KSCR220500086101

Calibration Certificate

Object	Apply	No	Model	SN	Calibration Date
Dipole	☐	1	CLA150	4025	2021/04/26
	☐	2	D450V3	1103	2021/04/21
	☐	3	D750V3	1188	2022/03/29
	☐	4	D835V2	4d114	2022/03/31
	☐	5	D900V2	1d079	2022/06/07
	☐	6	D1800V2	2d170	2022/03/31
	☐	7	D1900V2	5d1136	2022/06/07
	☐	8	D2000V2	1041	2022/06/06
	☐	9	D2300V2	1096	2022/03/31
	☒	10	D2450V2	817	2022/04/01
	☐	11	D2600V2	1158	2022/03/31
	☐	12	D5GHzV2	1095	2022/06/01
DAE	☒	13	DAE4	1245	2022/05/30
Probe	☒	14	EX3DV4	7346	2022/03/30



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1 Dipole

1.1 CLA150 - SN 4025

Calibration Laboratory of Schmid & Partner Engineering AG Zugstrasse 43, 8004 Zurich, Switzerland		S Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura S Swiss Calibration Service	
Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates		Accreditation No.: SCS 0108	
Client: SGS-CN (Audeon)		Certificate No.: CLA150-4025_Apr21	
CALIBRATION CERTIFICATE			
Object: CLA150 - SN: 4025			
Calibration procedure(s): QA CAL-15.v9 Calibration Procedure for SAR Validation Sources below 700 MHz			
Calibration date: April 26, 2021			
The calibration certificate documents the traceability to national standards, which require the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and on part of the certificate.			
All calibrations have been conducted in the closed laboratory facility; environment temperature (22 ± 3) °C and humidity < 70%.			
Calibration Equipment Used (M&E critical for calibration)			
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 10475	09-Apr-21 (No. 217-03001/03002)	Apr-22
Power sensor NRP Z01	SN: 10344	09-Apr-21 (No. 217-03001)	Apr-22
Power sensor NRP Z01	SN: 10345	09-Apr-21 (No. 217-03002)	Apr-22
Reference 20 dB Attenuator	SN: CC2002 (200)	09-Apr-21 (No. 217-03003)	Apr-22
Type-N mismatch combination	SN: 310002 / 0007	09-Apr-21 (No. 217-03004)	Apr-22
Reference Probe EX300A	SN: 3877	30-Dec-20 (No. 203-3077_Dec20)	Dec-21
EXE4	SN: 661	19-Jan-20 (No. 19459-659_Jan20)	Jan-21
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter S4419E	SN: G341303024	09-Apr-15 (in house check Jun-20)	In house check Jun-20
Power sensor E4113A	SN: MY4169007	09-Apr-15 (in house check Jun-20)	In house check Jun-20
Power sensor E4113A	SN: 00010010	09-Apr-15 (in house check Jun-20)	In house check Jun-20
RF generator HP 8364C	SN: U504001070	04-Aug-19 (in house check Jun-20)	In house check Jun-20
Network Analyzer Agilent T8368A	SN: U541000477	31-Mar-14 (in house check Oct-19)	In house check Oct-19
Calibrated by:	Johny Katsaros	Function: Laboratory Technician	Signature: [Signature]
Approved by:	Kajko Polovic	Function: Technical Manager	Signature: [Signature]
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Issued: April 26, 2021			
Certificate No: CLA150-4025_Apr21 Page 1 of 5			

Calibration Laboratory of Schmid & Partner Engineering AG Zugstrasse 43, 8004 Zurich, Switzerland		S Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura S Swiss Calibration Service	
Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates		Accreditation No.: SCS 0108	
Glossary:			
TSL	Issue simulating liquid		
ConvF	sensitivity in TSL / NORM x,y,z		
N/A	not applicable or not measured		
Calibration is Performed According to the Following Standards:			
a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Technique", June 2013			
b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016			
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010			
d) KDB 865864, "SAR Measurement Requirements for 100 MHz to 6 GHz"			
Additional Documentation:			
e) DASY4/5 System Handbook			
Methods Applied and Interpretation of Parameters:			
• Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.			
• Antenna Parameters with TSL: The source is mounted in a touch configuration below the center marking of the flat phantom.			
• Return Loss: This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.			
• SAR measured: SAR measured at the stated antenna input power.			
• SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.			
• SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the reported SAR result.			
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.			
Certificate No: CLA150-4025_Apr21 Page 2 of 5			

Measurement Conditions		
DASY system configuration, as far as not given on page 1.		
DASY Version	DASY5	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	ELIA Flat Phantom	Shell thickness: 2 ± 0.2 mm
EUT Positioning	Touch Position	
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	150 MHz ± 1 MHz	

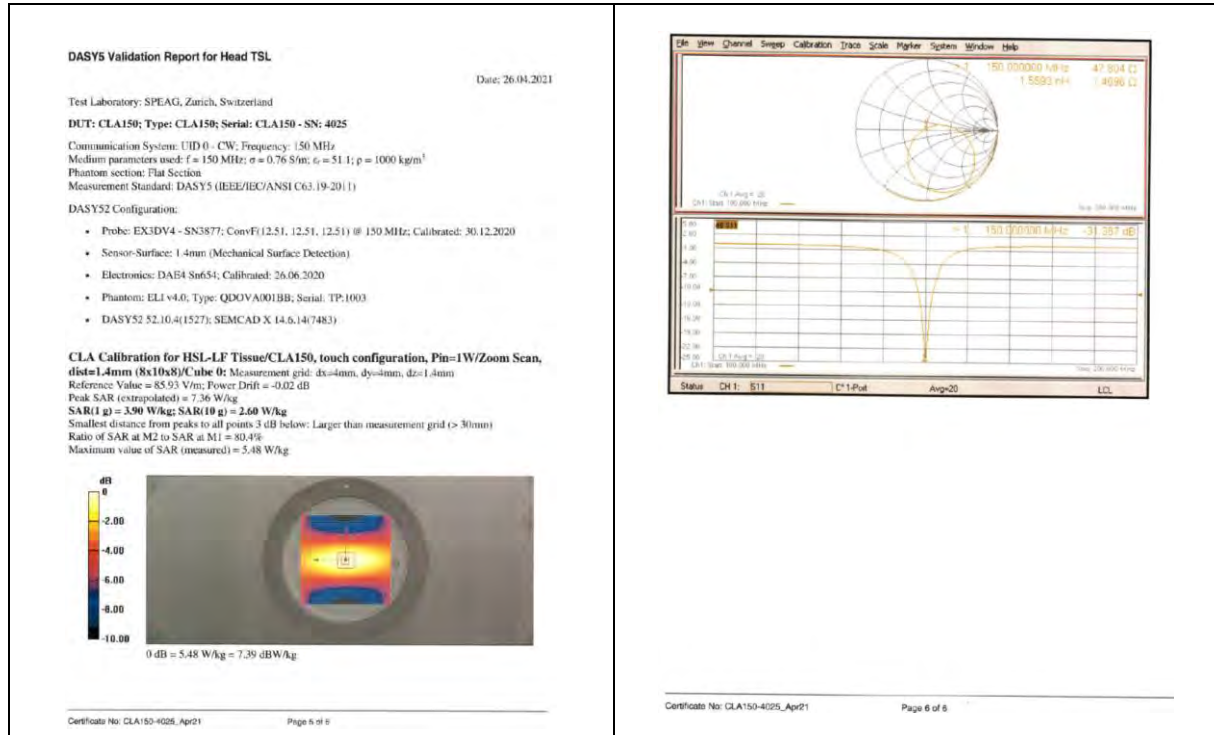
Head TSL parameters			
The following parameters and calculations were applied.			
	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	52.3	0.75 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	51.1 ± 6 %	0.75 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	---	---

SAR result with Head TSL		
SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	1 W input power	3.90 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	3.88 W/kg ± 19.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	1 W input power	2.60 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	2.59 W/kg ± 18.0 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)	
Antenna Parameters with Head TSL	
Impedance, transformed to feed point	47.9 Ω ± 1.5 Ω
Return Loss	-31.4 dB
Additional EUT Data	
Manufactured by	SPLEAG

Certificate No: CLA150-4025_Apr21 Page 3 of 5

Certificate No: CLA150-4025_Apr21 Page 4 of 5



1.2 D450V3 - SN 1103

Calibration Laboratory of Schmid & Partner Engineering AG
Zughestrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 0108

Client: **SGS-CN (Aiden)** Certificate No: **D450V3-1103_Apr21**

CALIBRATION CERTIFICATE

Object: **D450V3 - SN: 1103**

Calibration procedure(s): **QA CAL-15-V9**
Calibration Procedure for SAR Validation Sources below 700 MHz

Calibration date: **April 21, 2021**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (20 ± 0.5) °C and humidity < 75%.

Calibration Equipment used (MPE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN 104779	09-Apr-21 (No. 217-030110300)	Apr-22
Power sensor MNP-Z91	SN 103344	09-Apr-21 (No. 217-03011)	Apr-22
Power sensor MNP-Z91	SN 103345	09-Apr-21 (No. 217-03012)	Apr-22
Reference 20 dB Attenuator	SN C2552 (200)	09-Apr-21 (No. 217-03049)	Apr-22
Type-N impedance calibration	SN 310852 / 06327	09-Apr-21 (No. 217-03044)	Apr-22
Reference Probe EX3DV4	SN 3877	30-Dec-20 (No. EX3-2077 Dec20)	Dec-21
DAEA	SN 454	06-Jun-20 (No. D454-664-Jun20)	Jun-21

Secondary Standards

ID #	Cal Date (In House)	Scheduled Check
Power meter E41188	06-Apr-19 (In house check Jun-20)	In house check Jun-20
Power sensor E4112A	06-Apr-19 (In house check Jun-20)	In house check Jun-20
Power sensor E4112A	06-Apr-19 (In house check Jun-20)	In house check Jun-20
RF generator HP 8448C	06-Aug-19 (In house check Jun-20)	In house check Jun-20
Network Analyzer Agilent E8358A	31-Mar-14 (In house check Dec-20)	In house check Oct-21

Calibrated by: **Kuba Fomke** Function: **Laboratory Technician**

Approved by: **Kuba Fomke** Technical Manager

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Certificate No: D450V3-1103_Apr21 Page 1 of 6

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Accreditation No.: SCS 0108

Glossary:

TSL: Issue simulating liquid sensitivity in TSL / NORM x,y,z

ConvF: not applicable or not measured

N/A: not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 665664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Certificate No: D450V3-1103_Apr21 Page 2 of 6



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Measurement Conditions		
DASY system configuration, as far as not given on page 1.		
DASY Version	DASY5	V82.10.4
Extrapolation	Advanced Extrapolation	
Phantom	ELJ Flat Phantom	Shell thickness: 2 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	450 MHz ± 1 MHz	

Head TSL parameters			
The following parameters and calculations were applied:			
	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	43.5	0.57 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	43.1 ± 6 %	0.07 mho/m ± 8 %
Head TSL temperature change during test	< 0.5 °C	---	---

SAR result with Head TSL		
SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	4.55 W/kg ± 18.1 % (k=2)

SAR result with Head TSL		
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	0.757 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	3.06 W/kg ± 17.6 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)		
Antenna Parameters with Head TSL		
Impedance, transformed to feed point	57.1 Ω - j2.8 Ω	
Return Loss	-23.0 dB	

General Antenna Parameters and Design	
Electrical Delay (one direction)	1.346 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data	
Manufactured by	SPEAG

Certificate No: D450V3-1103_Apr21

Page 5 of 6

Certificate No: D450V3-1103_Apr21

Page 4 of 6

DASY5 Validation Report for Head TSL

Date: 21.04.2021

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN:1103

Communication System: UTD 0 - CW; Frequency: 450 MHz

Medium parameters used: f = 450 MHz, α = 0.87 S/m; ε_r = 43.1; ρ = 1000 kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF [10.64, 10.64] @ 450 MHz; Calibrated: 30.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 26.06.2020
- Phantom: ELJ v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.10.4 (1527); SEMCAD X (4.6.14/7483)

Dipole Calibration for Head Tissue d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 39.18 V/m; Power DfM = -0.08 dB

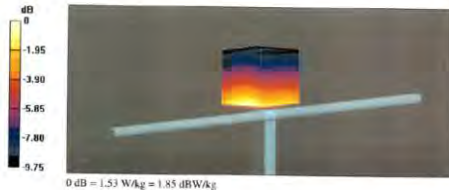
Peak SAR (extrapolated) = 1.76 W/kg

SAR(1 g) = 1.14 W/kg; SAR(10 g) = 0.767 W/kg

Smallest distance from peaks to all points 3 dB below: Larger than measurement grid

Ratio of SAR at M2 to SAR at M1 = 64.9%

Maximum value of SAR (measured) = 1.53 W/kg

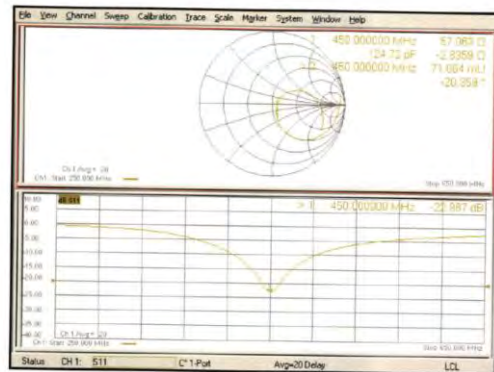


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Page 5 of 6

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Page 6 of 6



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1.3 D750V3 - SN 1188

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Client	SGS-CN	Certificate No.	Z22-60103
CALIBRATION CERTIFICATE			
Object	D750V3 - SN: 1188		
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits		
Calibration date:	March 28, 2022		
This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.			
All calibrations have been conducted in the closed laboratory facility; environment temperature (22±3)°C and humidity <70%.			
Calibration Equipment used (M&TE critical for calibration)			
Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Power Meter NRP2	104277	24-Sep-21 (CTTL No. J21X08328)	Sep-22
Power sensor NRP88	104291	24-Sep-21 (CTTL No. J21X08328)	Sep-22
Reference Probe EX30V4	SN 7307	26-May-21 (SPEAG No. EX3-7307_May21)	May-22
DAE4	SN 1556	12-Jan-22 (CTTL-SPEAG No. Z22-60007)	Jan-23
Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator S4436C	MY48071430	13-Jan-22 (CTTL No. J22X00406)	Jan-23
Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL No. J22X00406)	Jan-23
Calibrated by:	Name	Function	Signature
	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyun	SAR Project Leader	
Issued: April 3, 2022			
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Certificate No: Z22-60103		Page 1 of 6	

TTL Speag CALIBRATION LABORATORY		CAICT	
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Measurement Conditions DASY system configuration, as far as not given on page 1:			
DASY Version	DASY52	V52.10.4	
Extrapolation	Advanced Extrapolation		
Phantom	Triple Flat Phantom 5.1C		
Distance Dipole Center - TSL	15 mm	with Spacer	
Zoom Scan Resolution	dx, dy, dz = 5 mm		
Frequency	750 MHz ± 1 MHz		
Head TSL parameters The following parameters and calculations were applied:			
	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	42.0	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.4 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---
SAR result with Head TSL			
SAR averaged over 1 cm ² (1 g) of Head TSL	Condition		
SAR measured	250 mW input power	2.07 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	8.27 W/kg ± 18.8 % (k=2)	
SAR averaged over 10 cm ² (10 g) of Head TSL	Condition		
SAR measured	250 mW input power	1.37 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	5.48 W/kg ± 18.7 % (k=2)	
Certificate No: Z22-60103		Page 3 of 6	

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Glossary:			
TSL	Issue simulating liquid		
ConvF	sensitivity in TSL / NORMx.y.z		
N/A	not applicable or not measured		
Calibration is Performed According to the Following Standards:			
a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020			
b) KDB 855654, "SAR Measurement Requirements for 100 MHz to 6 GHz"			
Additional Documentation:			
c) DASY4/5 System Handbook			
Methods Applied and Interpretation of Parameters:			
• Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.			
• Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.			
• Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.			
• Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.			
• SAR measured: SAR measured at the stated antenna input power.			
• SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.			
• SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.			
The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.			
Certificate No: Z22-60103		Page 1 of 6	

TTL Speag CALIBRATION LABORATORY		CAICT	
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Appendix (Additional assessments outside the scope of CNAS L0570)			
Antenna Parameters with Head TSL			
Impedance, transformed to feed point	53.60- 1.13jΩ		
Return Loss	>28.7dB		
General Antenna Parameters and Design			
Electrical Delay (one direction)	0.947 ns		
After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.			
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small and caps are added to the dipole arms in order to improve matching when placed according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.			
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feed-point may be damaged.			
Additional EUT Data			
Manufactured by	SPEAG		
Certificate No: Z22-60103		Page 4 of 6	



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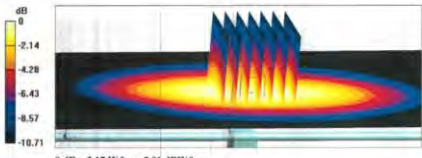
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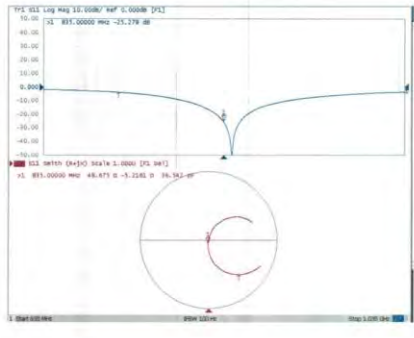
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Glossary: <table border="0"> <tr> <td>TSL</td> <td>tissue simulating liquid</td> </tr> <tr> <td>ConvT</td> <td>sensitivity in TSL / NORM_{xyz}</td> </tr> <tr> <td>N/A</td> <td>not applicable or not measured</td> </tr> </table>		TSL	tissue simulating liquid	ConvT	sensitivity in TSL / NORM _{xyz}	N/A	not applicable or not measured
TSL	tissue simulating liquid						
ConvT	sensitivity in TSL / NORM _{xyz}						
N/A	not applicable or not measured						
Calibration is Performed According to the Following Standards: - IECIEEIE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures" (Frequency range of 4 MHz to 10 GHz), October 2020 - KDB 826564, "SAR Measurement Requirements for 100 MHz to 6 GHz"							
Additional Documentation: DASY465 System Handbook							
Methods Applied and Interpretation of Parameters: Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated. Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis. Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required. Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required. SAR measured: SAR measured at the stated antenna input power. SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector. SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.							
The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.							



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Measurement Conditions DASY system configuration, as far as not given on page 1			
DASY Version	DASY52	VS2 10.4	
Extrapolation	Advanced Extrapolation		
Phantom	Triple Flat Phantom 5.1C		
Distance Dipole Center - TSL	15 mm	with Spacer	
Zoom Scan Resolution	dx, dy, dz = 5 mm		
Frequency	835 MHz ± 1 MHz		
Head TSL parameters The following parameters and calculations were applied:			
Nominal Head TSL parameters	Temperature	Permittivity	Conductivity
	22.0 °C	41.5	0.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.0 ± 0.5	0.81 mho/m ± 0.5%
Head TSL temperature change during last	< 1.0 °C	—	—
SAR result with Head TSL			
SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition		
SAR measured	250 mW input power	2.37 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	9.40 W/kg ± 18.8 % (k=2)	
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition		
SAR measured	250 mW input power	1.54 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	6.12 W/kg ± 18.7 % (k=2)	
Appendix (Additional assessments outside the scope of CNAS L0570)			
Antenna Parameters with Head TSL			
Impedance, transformed to feed point	48.70-5.22jΩ		
Return Loss	-25.3dB		
General Antenna Parameters and Design			
Electrical Delay (one direction)	1.307 ns		
After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.			
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.			
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feed-point may be damaged.			
Additional EUT Data			
Manufactured by	SPEAG		
Certificate No: Z22-60104 Page 1 of 6			

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DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 40114 Communication System: UHF 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1 Medium parameters used: f = 835 MHz; σ = 0.907 S/m; ε _r = 40.98; ρ = 1000 kg/m ³ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.9-2007) DASY5 Configuration:			
• Probe: EX3DV4 - SN7307; ConvF(10.13, 10.13, 10.13) @ 835 MHz; Calibrated: 2021-05-26			
• Sensor Surface: 1.4mm (Mechanical Surface Detection)			
• Electronics: DA64 Sn1556; Calibrated: 2022-01-12			
• Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062			
• DASY52 52.10.4(153); SEMCAD X 14.6.14(7501)			
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7) Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 57.88 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 3.56 W/kg SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.54 W/kg Smallest distance from peaks to all points 3 dB below = 15.8 mm Ratio of SAR at M2 to SAR at M1 = 66.2% Maximum value of SAR (measured) = 3.17 W/kg			
			
Certificate No: Z22-60104 Page 5 of 6			

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Impedance Measurement Plot for Head TSL			
			
Certificate No: Z22-60104 Page 6 of 6			



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1.5 D900V2 - SN 1d079

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Client: SGS-CN		Certificate No: Z22-60184	
CALIBRATION CERTIFICATE			
Object	D900V2 - SN 1d079		
Calibration Procedure(s)	PF-Z11-003-01 Calibration Procedures for dipole validation kits		
Calibration date	June 7, 2022		
The calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.			
All calibrations have been conducted in the closed laboratory facility, environment temperature (23±1°C) and humidity <70%.			
Calibration Equipment used (M&E critical for calibration)			
Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	24-Sep-21 (CTTL No. Z21X08326)	Sep-22
Power sensor NRP85	104291	24-Sep-21 (CTTL No. Z21X08326)	Sep-22
Reference Probe EX3DVA	SN 7484	28-Jan-22 (SPEAG No. EX3-7484_Jan22)	Jan-23
DAE4	SN 1586	12-Jan-22 (CTTL-SPEAG No. Z22-60007)	Jan-23
Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E2438C	MY48071430	13-Jan-22 (CTTL No. Z22X00406)	Jan-23
Network Analyzer E5071C	MY48110473	14-Jan-22 (CTTL No. Z22X00406)	Jan-23
Calibrated by:	Name	Function	Signature
	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyan	SAR Project Leader	
Issued: June 13, 2022 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			
Certificate No: Z22-60184		Page 1 of 4	

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Client: SGS-CN		Certificate No: Z22-60184	
Glossary: TSL: Issue simulating liquid ConvF: sensitivity in TSL / NORM.y,z N/A: not applicable or not measured			
Calibration is Performed According to the Following Standards: a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices-Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020 b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"			
Additional Documentation: c) DASYS4 System Handbook			
Methods Applied and Interpretation of Parameters: - Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated. - Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis. - Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required. - Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required. - SAR measured: SAR measured at the stated antenna input power. - SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector. - SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.			
The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.			
Certificate No: Z22-60184		Page 1 of 1	

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Client: SGS-CN		Certificate No: Z22-60184																			
Measurement Conditions DASY system configuration, as far as not given on page 1: <table border="1"> <tr> <td>DASY Version</td> <td>DASY52</td> <td>52.10.4</td> </tr> <tr> <td>Extrapolation</td> <td>Advanced Extrapolation</td> <td></td> </tr> <tr> <td>Phantom</td> <td>Tight Flat Phantom 5.1C</td> <td></td> </tr> <tr> <td>Distance Dipole Center - TSL</td> <td>15 mm</td> <td>with Spacer</td> </tr> <tr> <td>Zoom Scan Resolution</td> <td>0x, dy, dz = 5 mm</td> <td></td> </tr> <tr> <td>Frequency</td> <td>900 MHz ± 1 MHz</td> <td></td> </tr> </table>				DASY Version	DASY52	52.10.4	Extrapolation	Advanced Extrapolation		Phantom	Tight Flat Phantom 5.1C		Distance Dipole Center - TSL	15 mm	with Spacer	Zoom Scan Resolution	0x, dy, dz = 5 mm		Frequency	900 MHz ± 1 MHz	
DASY Version	DASY52	52.10.4																			
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Frequency	900 MHz ± 1 MHz																				
Head TSL parameters The following parameters and calculations were applied: <table border="1"> <tr> <th></th> <th>Temperature</th> <th>Permittivity</th> <th>Conductivity</th> </tr> <tr> <td>Nominal Head TSL parameters</td> <td>22.0 °C</td> <td>41.5</td> <td>0.97 mho/m</td> </tr> <tr> <td>Measured Head TSL parameters</td> <td>(22.0 ± 0.2) °C</td> <td>42.1 ± 6 %</td> <td>0.98 mho/m ± 6 %</td> </tr> <tr> <td>Head TSL temperature change during test</td> <td><+1.0 °C</td> <td>—</td> <td>—</td> </tr> </table>					Temperature	Permittivity	Conductivity	Nominal Head TSL parameters	22.0 °C	41.5	0.97 mho/m	Measured Head TSL parameters	(22.0 ± 0.2) °C	42.1 ± 6 %	0.98 mho/m ± 6 %	Head TSL temperature change during test	<+1.0 °C	—	—		
	Temperature	Permittivity	Conductivity																		
Nominal Head TSL parameters	22.0 °C	41.5	0.97 mho/m																		
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Head TSL temperature change during test	<+1.0 °C	—	—																		
SAR result with Head TSL <table border="1"> <tr> <th>SAR averaged over 1 cm² (1 g) of Head TSL</th> <th>Condition</th> <th></th> </tr> <tr> <td>SAR measured</td> <td>250 mW input power</td> <td>2.76 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>11.0 W/kg ± 18.8 % (k=2)</td> </tr> <tr> <td>SAR averaged over 10 cm² (10 g) of Head TSL</td> <td>Condition</td> <td></td> </tr> <tr> <td>SAR measured</td> <td>250 mW input power</td> <td>1.75 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>7.09 W/kg ± 18.7 % (k=2)</td> </tr> </table>				SAR averaged over 1 cm ² (1 g) of Head TSL	Condition		SAR measured	250 mW input power	2.76 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	11.0 W/kg ± 18.8 % (k=2)	SAR averaged over 10 cm ² (10 g) of Head TSL	Condition		SAR measured	250 mW input power	1.75 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	7.09 W/kg ± 18.7 % (k=2)
SAR averaged over 1 cm ² (1 g) of Head TSL	Condition																				
SAR measured	250 mW input power	2.76 W/kg																			
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SAR averaged over 10 cm ² (10 g) of Head TSL	Condition																				
SAR measured	250 mW input power	1.75 W/kg																			
SAR for nominal Head TSL parameters	normalized to 1W	7.09 W/kg ± 18.7 % (k=2)																			
Certificate No: Z22-60184		Page 1 of 4																			

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Client: SGS-CN		Certificate No: Z22-60184					
Appendix (Additional assessments outside the scope of CNAS L0670)							
Antenna Parameters with Head TSL <table border="1"> <tr> <td>Impedance, transformed to feed point</td> <td>48 (1.0 - 9.45j)</td> </tr> <tr> <td>Return Loss</td> <td>-23.3 dB</td> </tr> </table>				Impedance, transformed to feed point	48 (1.0 - 9.45j)	Return Loss	-23.3 dB
Impedance, transformed to feed point	48 (1.0 - 9.45j)						
Return Loss	-23.3 dB						
General Antenna Parameters and Design <table border="1"> <tr> <td>Electrical Delay (90° direction)</td> <td>1.312 ns</td> </tr> </table>				Electrical Delay (90° direction)	1.312 ns		
Electrical Delay (90° direction)	1.312 ns						
After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured. The dipole is made of standard serringid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feed-point may be damaged.							
Additional EUT Data <table border="1"> <tr> <td>Manufactured by</td> <td>SPEAG</td> </tr> </table>				Manufactured by	SPEAG		
Manufactured by	SPEAG						
Certificate No: Z22-60184		Page 1 of 6					

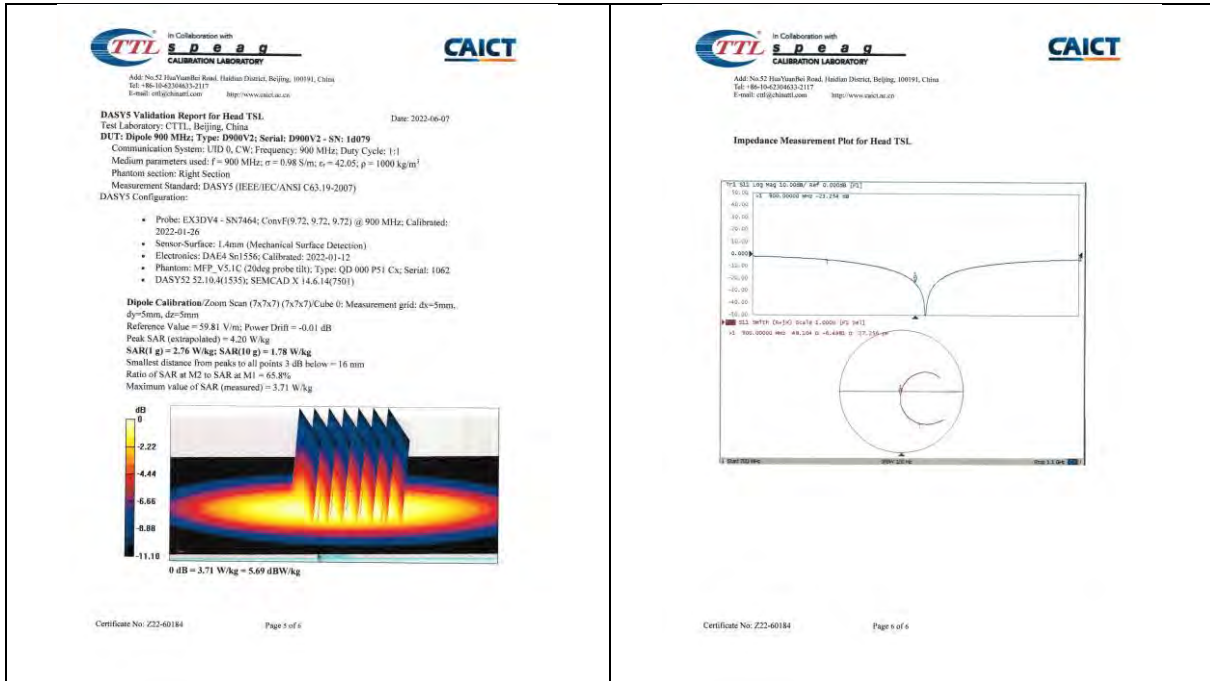


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1.6 D1800V2 - SN 2d170

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CALIBRATION CERTIFICATE

Object: **D1800V2 - SN: 2d170**

Calibration Procedure(s): **FF-Z11-003-01**
Calibration Procedures for dipole validation kits

Calibration date: **March 31, 2022**

This calibration Certificate documents the traceability to national standards, which realizes the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility, environment temperature (22±3)°C and humidity <70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	24-Sep-21 (CTTL No.J21X08326)	Sep-22
Power sensor NRP8S	104291	24-Sep-21 (CTTL No.J21X08326)	Sep-22
Reference Probe EX3DV4	SN 7307	26-May-21 (SPEAG No.EX3-7307_May21)	May-22
DAE4	SN 1556	12-Jan-22 (CTTL-SPEAG No.Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY48071430	13-Jan-22 (CTTL No.J22X00409)	Jan-23
Network Analyzer E5071C	MY48110673	14-Jan-22 (CTTL No.J22X00409)	Jan-23

Calibrated by: **Zhao Jing** SAR Test Engineer
Reviewed by: **Lin Hao** SAR Test Engineer
Approved by: **Qi Diqian** SAR Project Leader

Issued: April 6, 2022
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Certificate No: Z22-60105 Page 1 of 6

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E-mail: cti@china.ttl.com
http://www.china.ttl.com

CAICT

Glossary:
TSL: tissue simulating liquid
ConvF: sensitivity in TSL / NORM_{x,y,z}
N/A: not applicable or not measured

Calibration is Performed According to the Following Standards:
a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
b) KDB 855664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:
c) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Certificate No: Z22-60105 Page 2 of 6

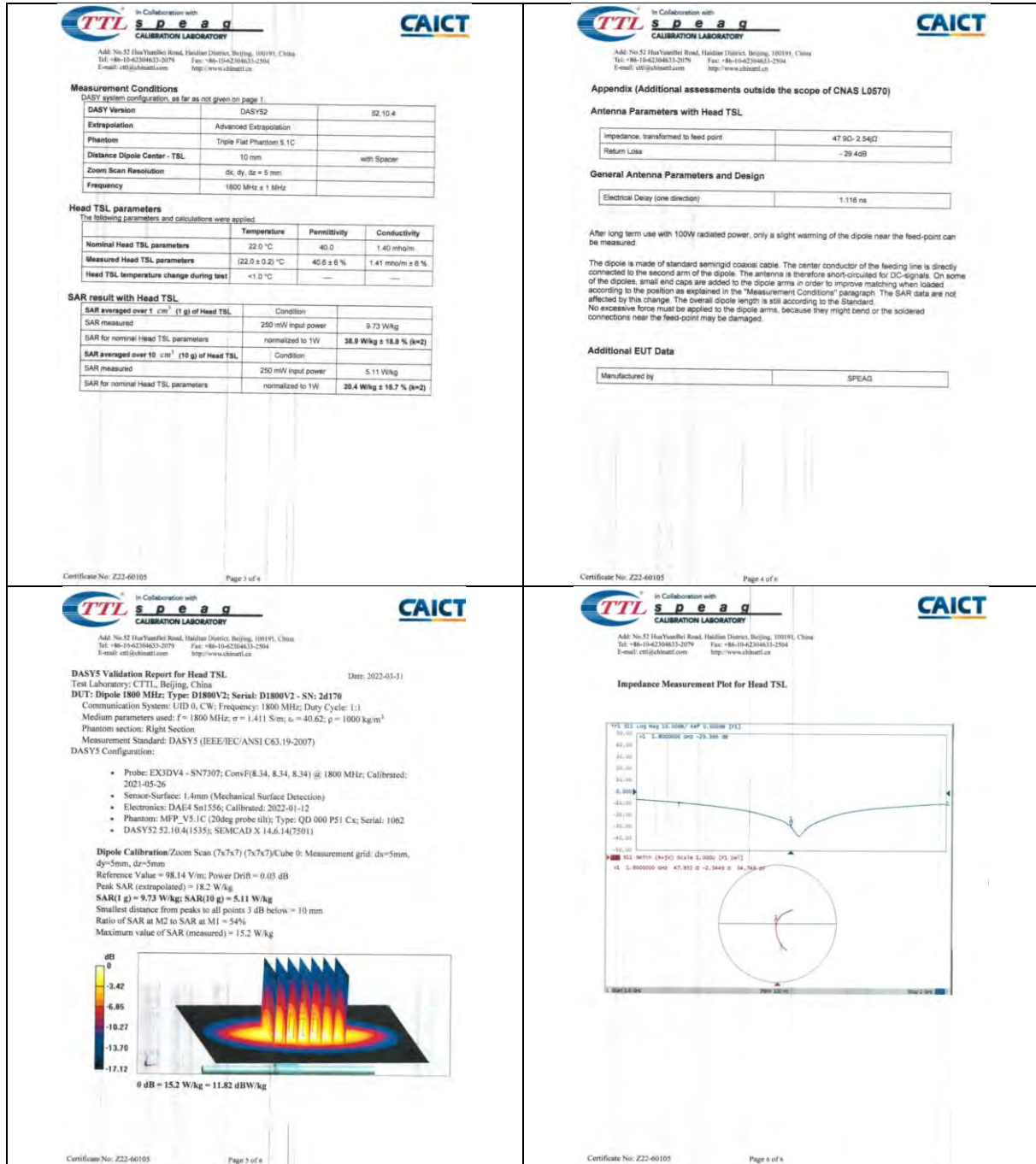


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1.7 D1900V2 - SN 5d136

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Client: SGS-CN		Certificate No: Z22-60185																					
CALIBRATION CERTIFICATE																							
Object: D1900V2 - SN 5d136																							
Calibration Procedure(s): FF-Z11-003-01 Calibration Procedures for dipole validation kits																							
Calibration date: June 7, 2022																							
This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.																							
All calibrations have been conducted in the closed laboratory facility, environment temperature (23±1)°C and humidity <70%.																							
Calibration Equipment used (M&E critical for calibration)																							
<table border="1"><thead><tr><th>Primary Standards</th><th>ID #</th><th>Cal Date (Calibrated by Certificate No.)</th><th>Scheduled Calibration</th></tr></thead><tbody><tr><td>Power Meter NRP2</td><td>106277</td><td>24-Sep-21 (CTTL No.J21X08326)</td><td>Sep-22</td></tr><tr><td>Power sensor NRP85</td><td>104291</td><td>24-Sep-21 (CTTL No.J21X08326)</td><td>Sep-22</td></tr><tr><td>Reference Probe EX3DV4</td><td>SN 7404</td><td>28-Jan-22 (SPEAG No EX3-7404_Jan22)</td><td>Jan-23</td></tr><tr><td>DAEA</td><td>SN 1558</td><td>12-Jan-22 (CTTL-SPEAG No Z22-60007)</td><td>Jan-23</td></tr></tbody></table>				Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration	Power Meter NRP2	106277	24-Sep-21 (CTTL No.J21X08326)	Sep-22	Power sensor NRP85	104291	24-Sep-21 (CTTL No.J21X08326)	Sep-22	Reference Probe EX3DV4	SN 7404	28-Jan-22 (SPEAG No EX3-7404_Jan22)	Jan-23	DAEA	SN 1558	12-Jan-22 (CTTL-SPEAG No Z22-60007)	Jan-23
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Calibrated by: Name: Zhao Jing, Function: SAR Test Engineer, Signature: [Signature]																							
Reviewed by: Lin Hao, SAR Test Engineer, Signature: [Signature]																							
Approved by: Qi Dianyan, SAR Project Leader, Signature: [Signature]																							
Issued: June 13, 2022																							
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Certificate No: Z22-60185		Page 1 of 8																					

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Measurement Conditions QASYS system configuration, as far as not given on page 1:																					
<table border="1"><thead><tr><th>DASY Version</th><th>DASY152</th><th>52.10.4</th></tr></thead><tbody><tr><td>Extrapolation</td><td>Advanced Extrapolation</td><td></td></tr><tr><td>Phantom</td><td>Triple Flat Phantom 5.1C</td><td></td></tr><tr><td>Distance Dipole Center - TSL</td><td>10 mm</td><td>with Spacer</td></tr><tr><td>Zoom Scan Resolution</td><td>dx, dy, dz = 5 mm</td><td></td></tr><tr><td>Frequency</td><td>1900 MHz ± 1 MHz</td><td></td></tr></tbody></table>				DASY Version	DASY152	52.10.4	Extrapolation	Advanced Extrapolation		Phantom	Triple Flat Phantom 5.1C		Distance Dipole Center - TSL	10 mm	with Spacer	Zoom Scan Resolution	dx, dy, dz = 5 mm		Frequency	1900 MHz ± 1 MHz	
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Head TSL parameters The following parameters and calculations were applied:																					
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<table border="1"><thead><tr><th>SAR averaged over 1 cm² (1 g) of Head TSL</th><th>Condition</th><th>Value</th></tr></thead><tbody><tr><td>SAR measured</td><td>250 mW input power</td><td>9.65 W/kg</td></tr><tr><td>SAR for nominal Head TSL parameters</td><td>normalized to 1W</td><td>40.0 W/kg ± 16.8 % (k=2)</td></tr><tr><td>SAR averaged over 10 cm² (10 g) of Head TSL</td><th>Condition</th><th>Value</th></tr><tr><td>SAR measured</td><td>250 mW input power</td><td>5.18 W/kg</td></tr><tr><td>SAR for nominal Head TSL parameters</td><td>normalized to 1W</td><td>20.8 W/kg ± 16.7 % (k=2)</td></tr></tbody></table>				SAR averaged over 1 cm ² (1 g) of Head TSL	Condition	Value	SAR measured	250 mW input power	9.65 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	40.0 W/kg ± 16.8 % (k=2)	SAR averaged over 10 cm ² (10 g) of Head TSL	Condition	Value	SAR measured	250 mW input power	5.18 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	20.8 W/kg ± 16.7 % (k=2)
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Certificate No: Z22-60185		Page 3 of 8																			

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Glossary: TSL: Issue simulating liquid sensitivity in TSL / NORM.y.z ConF: not applicable or not measured NA: not applicable or not measured			
Calibration is Performed According to the Following Standards: a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020 b) KDB 855884, "SAR Measurement Requirements for 100 MHz to 6 GHz" Additional Documentation: c) DASY4/5 System Handbook			
Methods Applied and Interpretation of Parameters: • Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated. • Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis. • Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required. • Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required. • SAR measured: SAR measured at the stated antenna input power. • SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector. • SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.			
The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.			
Certificate No: Z22-60185		Page 2 of 8	

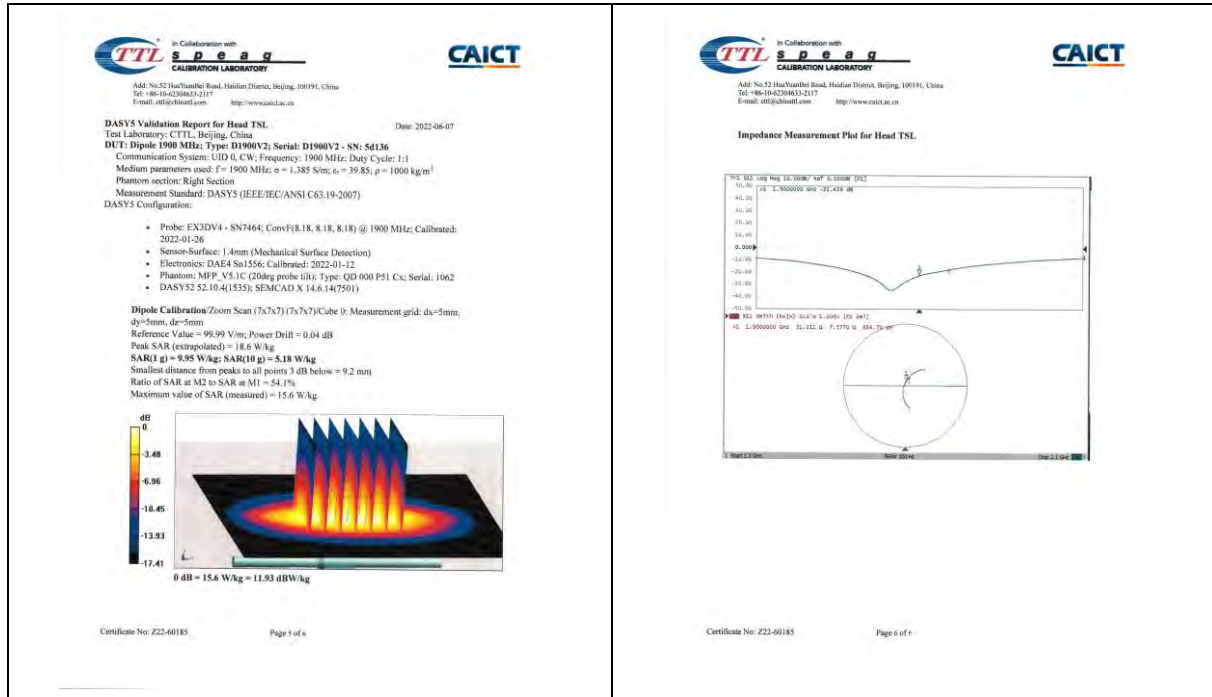
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Appendix (Additional assessments outside the scope of CNAS L0570)									
Antenna Parameters with Head TSL									
<table border="1"><thead><tr><th>Parameter</th><th>Value</th></tr></thead><tbody><tr><td>Impedance, transformed to feed point</td><td>51.0Ω ± 1.5Ω (k=2)</td></tr><tr><td>Return Loss</td><td>22.4dB</td></tr></tbody></table>				Parameter	Value	Impedance, transformed to feed point	51.0Ω ± 1.5Ω (k=2)	Return Loss	22.4dB
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General Antenna Parameters and Design									
<table border="1"><thead><tr><th>Parameter</th><th>Value</th></tr></thead><tbody><tr><td>Electrical Delay (one direction)</td><td>1.109 ns</td></tr></tbody></table>				Parameter	Value	Electrical Delay (one direction)	1.109 ns		
Parameter	Value								
Electrical Delay (one direction)	1.109 ns								
After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.									
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC signals. On some of the dipoles, small caps are added to the dipole arms in order to improve matching when loaded according to the position as specified in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feed-point may be damaged.									
Additional EUT Data									
<table border="1"><thead><tr><th>Manufacturer by</th><th>SPEAG</th></tr></thead><tbody><tr><td></td><td></td></tr></tbody></table>				Manufacturer by	SPEAG				
Manufacturer by	SPEAG								
Certificate No: Z22-60185		Page 4 of 8							



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1.8 D2000V2 - SN 1041

Page 1 of 6:

Calibration Certificate
Client: SGS-CN Certificate No: Z22-60186
Object: D2000V2 - SN: 1041
Calibration Procedure(s): FF-Z11-003-01
Calibration date: June 5, 2022
This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.
All calibrations have been conducted in the closed laboratory facility: environment temperature (23±3)°C and humidity <70%.
Calibration Equipment used (MATE critical for calibration):
Primary Standards: ID #, Cal Date (Calibrated by Certificate No.), Scheduled Calibration
Power Meter: NRP2, 106277, 24-Sep-21 (CTTL No. J21X08328), Sep-22
Power sensor: NRP2S, 104291, 24-Sep-21 (CTTL No. J21X08328), Sep-22
Reference Probe: EX3DV4, SN 7464, 26-Jan-22 (SPEAG No. EX3-7464, Jan22), Jan-23
DAE4, SN 1556, 12-Jan-22 (CTTL - SPEAG No. Z22-60007), Jan-23
Secondary Standards: ID #, Cal Date (Calibrated by Certificate No.), Scheduled Calibration
Signal Generator: E4438C, MY49071430, 13-Jan-22 (CTTL No. Z22X00408), Jan-23
Network Analyzer: E5071C, MY46110673, 14-Jan-22 (CTTL No. Z22X00408), Jan-23
Calibrated by: Zhao Jing, SAR Test Engineer, Signature
Reviewed by: Lin Hao, SAR Test Engineer, Signature
Approved by: Qi Dianyan, SAR Project Leader, Signature
Issued: June 13, 2022
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Certificate No: Z22-60186 Page 1 of 6

Page 6 of 6:

Glossary:
TSL: Issue simulating liquid
ConvF: sensitivity in TSL / NORMx.y.z
N/A: not applicable or not measured
Calibration is Performed According to the Following Standards:
a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-Head and Body-Mounted Wireless Communication Devices: Part 1528 Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
b) KDB 865564, "SAR Measurement Requirements for 100 MHz to 6 GHz"
Additional Documentation:
c) DASYS System Handbook
Methods Applied and Interpretation of Parameters:
• Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
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Certificate No: Z22-60186 Page 6 of 6

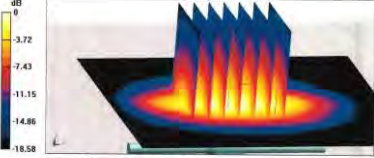
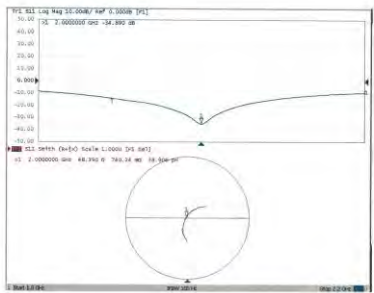


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In Collaboration with TTL speaq CALIBRATION LABORATORY CAICT Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-6204832-2117 E-mail: en@sgs.com.cn http://www.sgs.com.cn Measurement Conditions DASY system configuration, as for as not given on page 1. <table border="1"><tr><td>DASY Version</td><td>DASYV2</td><td>52.10.4</td></tr><tr><td>Extrapolation</td><td>Advanced Extrapolation</td><td></td></tr><tr><td>Phantom</td><td>Triple Flat Phantom S.1C</td><td></td></tr><tr><td>Distance Dipole Center - TSL</td><td>10 mm</td><td>with Spacer</td></tr><tr><td>Zoom Scan Resolution</td><td>dx, dy, dz = 5 mm</td><td></td></tr><tr><td>Frequency</td><td>2000 MHz ± 1 MHz</td><td></td></tr></table> Head TSL parameters The following parameters and calculations were applied: <table border="1"><tr><th></th><th>Temperature</th><th>Permittivity</th><th>Conductivity</th></tr><tr><td>Nominal Head TSL parameters</td><td>22.9 °C</td><td>40.0</td><td>1.40 mS/m</td></tr><tr><td>Measured Head TSL parameters</td><td>(22.0 ± 0.2) °C</td><td>40.2 ± 0.6 %</td><td>1.36 mS/m ± 0.6 %</td></tr><tr><td>Head TSL temperature change during test</td><td>-1.0 °C</td><td></td><td></td></tr></table> SAR result with Head TSL <table border="1"><tr><th></th><th>Condition</th><th></th></tr><tr><td>SAR averaged over 1 cm³ (1 g) of Head TSL</td><td></td><td></td></tr><tr><td>SAR measured</td><td>250 mW input power</td><td>10.4 W/kg</td></tr><tr><td>SAR for nominal Head TSL parameters</td><td>normalized to 1W</td><td>41.8 W/kg ± 15.8 % (n=2)</td></tr><tr><td>SAR averaged over 10 cm³ (10 g) of Head TSL</td><td></td><td></td></tr><tr><td>SAR measured</td><td>250 mW input power</td><td>5.30 W/kg</td></tr><tr><td>SAR for nominal Head TSL parameters</td><td>normalized to 1W</td><td>21.3 W/kg ± 18.7 % (n=2)</td></tr></table> Certificate No: Z22-60186 Page 3 of 6	DASY Version	DASYV2	52.10.4	Extrapolation	Advanced Extrapolation		Phantom	Triple Flat Phantom S.1C		Distance Dipole Center - TSL	10 mm	with Spacer	Zoom Scan Resolution	dx, dy, dz = 5 mm		Frequency	2000 MHz ± 1 MHz			Temperature	Permittivity	Conductivity	Nominal Head TSL parameters	22.9 °C	40.0	1.40 mS/m	Measured Head TSL parameters	(22.0 ± 0.2) °C	40.2 ± 0.6 %	1.36 mS/m ± 0.6 %	Head TSL temperature change during test	-1.0 °C				Condition		SAR averaged over 1 cm ³ (1 g) of Head TSL			SAR measured	250 mW input power	10.4 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	41.8 W/kg ± 15.8 % (n=2)	SAR averaged over 10 cm ³ (10 g) of Head TSL			SAR measured	250 mW input power	5.30 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	21.3 W/kg ± 18.7 % (n=2)	In Collaboration with TTL speaq CALIBRATION LABORATORY CAICT Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-6204832-2117 E-mail: en@sgs.com.cn http://www.sgs.com.cn Appendix (Additional assessments outside the scope of CNAS L0570) Antenna Parameters with Head TSL <table border="1"><tr><td>Impedance, transformed to feed point</td><td>48.4Ω ± 0.74Ω</td></tr><tr><td>Return Loss</td><td>-34.8dB</td></tr></table> General Antenna Parameters and Design <table border="1"><tr><td>Electrical Delay (one direction)</td><td>1.08 ns</td></tr></table> After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured. The dipole is made of standard semi-rigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small and large are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feed-point may be damaged. Additional EUT Data <table border="1"><tr><td>Manufactured by</td><td>SPEAQ</td></tr></table> Certificate No: Z22-60186 Page 8 of 8	Impedance, transformed to feed point	48.4Ω ± 0.74Ω	Return Loss	-34.8dB	Electrical Delay (one direction)	1.08 ns	Manufactured by	SPEAQ
DASY Version	DASYV2	52.10.4																																																														
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Manufactured by	SPEAQ																																																															
In Collaboration with TTL speaq CALIBRATION LABORATORY CAICT Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-6204832-2117 E-mail: en@sgs.com.cn http://www.sgs.com.cn DASY Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China DUT: Dipole 2000 MHz; Type: D2000V2; Serial: D2000V2 - SN: 1041 Communication System: UTD 0; CW; Frequency: 2000 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2000 MHz; σ = 1.392 S/m; ε = 40.21; ρ = 1000 kg/m³ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) DASY5 Configuration: - Probe: EX3DV4 - SN7464; ConvF(R2, R2, R2) @ 2000 MHz; Calibrated: 2022-01-26 - Sensor Surface: 1.4mm (Mechanical Surface Detection) - Electronics: DA64 Sn1556; Calibrated: 2022-01-12 - Phantom: MPP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062 - DASY5: S2.10.4(1535); SEMCAD X 14.6.14(7501) Dipole Calibration/Zoom Scan (7x7x7) (7x7x7) Cube (0; Measurement grid: dx=5mm, dy=5mm, dz=5mm) Reference Value = 103.4 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 19.6 W/kg SAR(1 g) = 10.4 W/kg; SAR(10 g) = 5.3 W/kg Smallest distance from peaks to all points 3 dB below = 9.1 mm Ratio of SAR at M2 to SAR at M1 = 51.0 % Maximum value of SAR (measured) = 16.3 W/kg  0 dB = 16.3 W/kg = 12.12 dBW/kg Certificate No: Z22-60186 Page 5 of 6	In Collaboration with TTL speaq CALIBRATION LABORATORY CAICT Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-6204832-2117 E-mail: en@sgs.com.cn http://www.sgs.com.cn Impedance Measurement Plot for Head TSL  Certificate No: Z22-60186 Page 6 of 6																																																															



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1.9 D2300V2 - SN 1096

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Client: SGS-CN		Certificate No: Z22-60106	
CALIBRATION CERTIFICATE			
Object	D2300V2 - SN 1096		
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits		
Calibration date:	March 31, 2022		
This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.			
All calibrations have been conducted in the closed laboratory facility: environment temperature (22±3)°C and humidity <70%.			
Calibration Equipment used (M&TE critical for calibration)			
Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Power Meter NRP2	108277	24-Sep-21 (CTTL No.J21X08328)	Sep-22
Power sensor NRP8	104291	24-Sep-21 (CTTL No.J21X08328)	Sep-22
Reference Probe EX33V4 DA4	SN 7307 SN 1556	26-May-21 (SPEAG No.EK3-7307_May21) 12-Jan-22 (CTTL-SPEAG No.Z22-60007)	May-22 Jan-23
Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E4439C	MY49071430	13-Jan-22 (CTTL No.J22X00406)	Jan-23
Network Analyzer E5071C	MY48110673	14-Jan-22 (CTTL No.J22X00406)	Jan-23
Calibrated by:	Name: Zhao Jing	Function: SAR Test Engineer	Signature: [Signature]
Reviewed by:	Name: Lin Hao	Function: SAR Test Engineer	Signature: [Signature]
Approved by:	Name: Qi Dianyan	Function: SAR Project Leader	Signature: [Signature]
Issued: April 6, 2022			
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Certificate No: Z22-60106		Page 1 of 6	

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Measurement Conditions DASY system configuration, as far as not given on page 1:			
DASY Version	DASY2	52.10.4	
Extrapolation	Advanced Extrapolation		
Phantom	Triple Flat Phantom 5.1C		
Distance Dipole Center - TSL	10 mm	with Spacer	
Zoom Scan Resolution	dx, dy, dz = 5 mm		
Frequency	2300 MHz ± 1 MHz		
Head TSL parameters The following parameters and calculations were applied:			
	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.5	1.67 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.8 ± 9 %	1.70 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	—	
SAR result with Head TSL			
SAR averaged over 1 cm ² (1 g) of Head TSL	Condition		
SAR measured	250 mW input power	12.4 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	49.2 W/kg ± 18.8 % (k=2)	
SAR averaged over 10 cm ² (10 g) of Head TSL	Condition		
SAR measured	250 mW input power	5.88 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	23.4 W/kg ± 18.7 % (k=2)	
Certificate No: Z22-60106		Page 3 of 6	

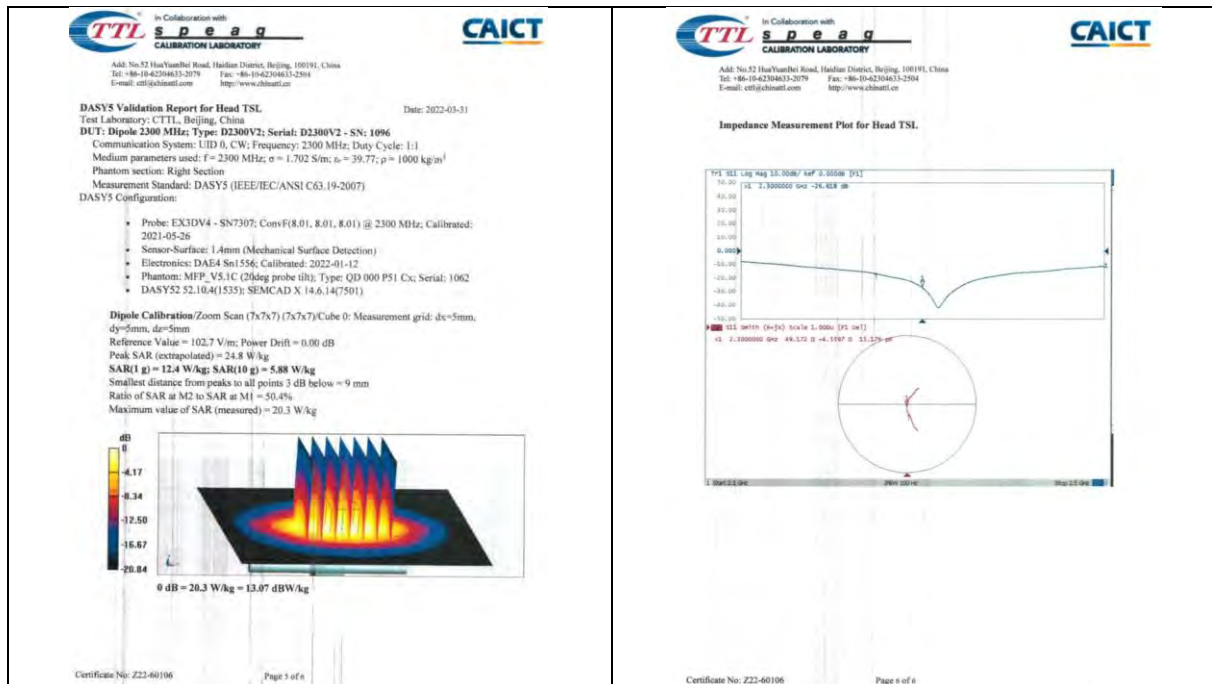
TTL Speaq CALIBRATION LABORATORY		CAICT	
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Appendix (Additional assessments outside the scope of CNAS L0570)			
Antenna Parameters with Head TSL			
Impedance, transformed to feed point	49.20 - 4.50j		
Return Loss	-26.6dB		
General Antenna Parameters and Design			
Electrical Delay (one direction)	1.083 ns		
After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.			
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when backed according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feed-point may be damaged.			
Additional EUT Data			
Manufactured by	SPEAG		
Certificate No: Z22-60106		Page 4 of 6	



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1.10 D2450V2 - SN 817

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Client: **SGS-CN** Certificate No: **Z22-60107**

CALIBRATION CERTIFICATE

Object: **D2450V2 - SN 817**

Calibration Procedure(s): **FF-Z11-003-3**
Calibration Procedures for dipole validation kits

Calibration date: **April 1, 2022**

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements [B]. The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22±3)°C and humidity <70%.

Calibration Equipment used (M&E critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by: Certificate No.)	Scheduled Calibration
Power Meter: NRP2	106277	24-Sep-21 (CTTL No.J21X08326)	Sep-22
Power sensor: NRP8S	104291	24-Sep-21 (CTTL No.J21X08326)	Sep-22
Reference Probe EX3DV4	SN 7307	25-May-21(SPEAG.No EX3-7307_May21)	May-22
DAE4	SN 1555	12-Jan-22(CTTL-SPEAG.No Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by: Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-22 (CTTL No.J22X00406)	Jan-23
Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL No.J22X00406)	Jan-23

Calibrated by: **Zhao Jing** SAR Test Engineer

Reviewed by: **Liu Hao** SAR Test Engineer

Approved by: **Qi Dianyan** SAR Project Leader

Issued: April 6, 2022

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Certificate No: Z22-60107 Page 1 of 5

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Glossary:

TSL: tissue simulating liquid
ConvF: sensitivity in TSL / NORMix.y.z
N/A: not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 5 GHz"

Additional Documentation:

c) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor: $k=2$, which for a normal distribution Corresponds to a coverage probability of approximately 95%.

Certificate No: Z22-60107 Page 2 of 5

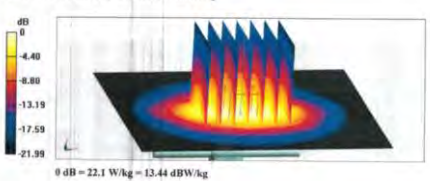
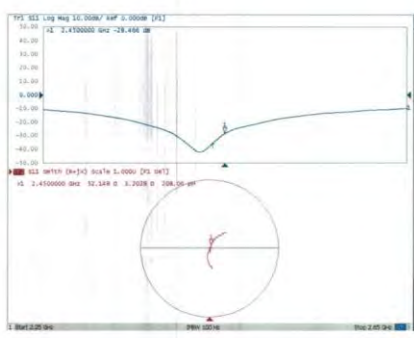


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DASY Version	DASY52	52.10.4																		
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Measured Head TSL parameters	(22.0 ± 0.2) °C	39.5 ± 6 %	1.79 mho/m ± 8 %																	
Head TSL temperature change during test	<1.0 °C	—	—																	
SAR result with Head TSL <table border="1"> <tr> <th>SAR averaged over 1 cm³ (1 g) of Head TSL</th> <th>Condition</th> <th></th> </tr> <tr> <td>SAR measured</td> <td>250 mW input power</td> <td>13.2 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>53.0 W/kg ± 18.8 % (k=2)</td> </tr> <tr> <td>SAR averaged over 10 cm³ (10 g) of Head TSL</td> <th>Condition</th> <th></th> </tr> <tr> <td>SAR measured</td> <td>250 mW input power</td> <td>6.15 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>24.7 W/kg ± 18.7 % (k=2)</td> </tr> </table>			SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition		SAR measured	250 mW input power	13.2 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	53.0 W/kg ± 18.8 % (k=2)	SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition		SAR measured	250 mW input power	6.15 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	24.7 W/kg ± 18.7 % (k=2)
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Certificate No: Z22-40107 Page 1 of 6																				
Appendix (Additional assessments outside the scope of CNAS L0570) Antenna Parameters with Head TSL <table border="1"> <tr> <td>Impedance, transformed to feed point</td> <td>52.10 ± 3.20j</td> </tr> <tr> <td>Return Loss</td> <td>~26.5dB</td> </tr> </table> General Antenna Parameters and Design <table border="1"> <tr> <td>Electrical Delay (one direction)</td> <td>1.006 ns</td> </tr> </table> After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured. The dipole is made of standard ferrinoid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feed-point may be damaged. Additional EUT Data <table border="1"> <tr> <td>Manufactured by</td> <td>SPEAG</td> </tr> </table>			Impedance, transformed to feed point	52.10 ± 3.20j	Return Loss	~26.5dB	Electrical Delay (one direction)	1.006 ns	Manufactured by	SPEAG										
Impedance, transformed to feed point	52.10 ± 3.20j																			
Return Loss	~26.5dB																			
Electrical Delay (one direction)	1.006 ns																			
Manufactured by	SPEAG																			
Certificate No: Z22-40107 Page 1 of 6																				
DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China Date: 2022-04-01 DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 817 Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2450 MHz; σ = 1.79 S/m; ε = 39.52; ρ = 1000 kg/m³ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) DASY5 Configuration: - Probe: EX3DV4 - SN7307; ConvF(7.75, 7.75) @ 2450 MHz; Calibrated: 2021-05-26 - Sensor-Surface: 1.4mm (Mechanical Surface Detection) - Electronics: DA14 Snt 556; Calibrated: 2022-01-12 - Phantom: MFP, V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062 - DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501) Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 104.6 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 27.0 W/kg SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.15 W/kg Smallest distance from peaks to all points 3 dB below = 8.9 mm Ratio of SAR at M2 to SAR at M1 = -49.2% Maximum value of SAR (measured) = 22.1 W/kg 																				
Certificate No: Z22-40107 Page 1 of 6																				
Impedance Measurement Plot for Head TSL 																				
Certificate No: Z22-40107 Page 1 of 6																				



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1.11 D2600V2 - SN 1158

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Client: SGS-CN	Certificate No: Z22-60108		
CALIBRATION CERTIFICATE			
Object	D2600V2 - SN: 1158		
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits		
Calibration date:	March 31, 2022		
This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.			
All calibrations have been conducted in the closed laboratory facility: environment temperature (23±3)°C and humidity<70%.			
Calibration Equipment used (MSTE critical for calibration)			
Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Power Meter NRP2	108277	24-Sep-21 (CTTL No.J21X08326)	Sep-22
Power sensor NRP8	104291	24-Sep-21 (CTTL No.J21X08326)	Sep-22
Reference Probe EX30V4	SN 7307	26-May-21 (SPEAG No EX3-7307_May21)	May-22
DAE4	SN 1556	12-Jan-22 (CTTL-SPEAG No Z22-60007)	Jan-23
Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY48071430	13-Jan-22 (CTTL No.Z22X00406)	Jan-23
Network Analyzer E5071C	MY48110673	14-Jan-22 (CTTL No.Z22X00406)	Jan-23
Calibrated by:	Name	Function	Signature
	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyan	SAR Project Leader	
Issued: April 6, 2022			
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Certificate No: Z22-60108	Page 1 of 6		

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Measurement Conditions DASY system configuration, as far as not given on page 1.		Appendix (Additional assessments outside the scope of CNAS L0570)					
DASY Version	DASY52	52.10.4					
Extrapolation	Advanced Extrapolation						
Phantom	Triple Flat Phantom S.1C						
Distance Dipole Center - TSL	10 mm	with Spacer					
Zoom Scan Resolution	dx, dy, dz = 5 mm						
Frequency	2600 MHz ± 1 MHz						
Head TSL parameters The following parameters and calculations were applied:							
	Temperature	Permittivity	Conductivity				
Nominal Head TSL parameters	22.0 °C	38.0	1.96 mho/m				
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.7 ± 6 %	1.96 mho/m ± 6 %				
Head TSL temperature change during test	< ± 0.2 °C	---	---				
SAR result with Head TSL							
SAR averaged over 1 cm² (1 g) of Head TSL	Condition						
SAR measured	250 mW input power	13.7 W/kg					
SAR for nominal Head TSL parameters	normalized to 1W	54.8 W/kg ± 18.8 % (k=2)					
SAR averaged over 10 cm² (10 g) of Head TSL	Condition						
SAR measured	250 mW input power	6.12 W/kg					
SAR for nominal Head TSL parameters	normalized to 1W	24.5 W/kg ± 18.7 % (k=2)					
Antenna Parameters with Head TSL <table border="1"> <tr> <td>Impedance, transformed to feed point</td> <td>49.90 - j6.48Ω</td> </tr> <tr> <td>Return Loss</td> <td>-23.9dB</td> </tr> </table>				Impedance, transformed to feed point	49.90 - j6.48Ω	Return Loss	-23.9dB
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After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured. The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feed-point may be damaged.							
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Manufactured by	SPEAG						
Certificate No: Z22-60108	Page 3 of 6						

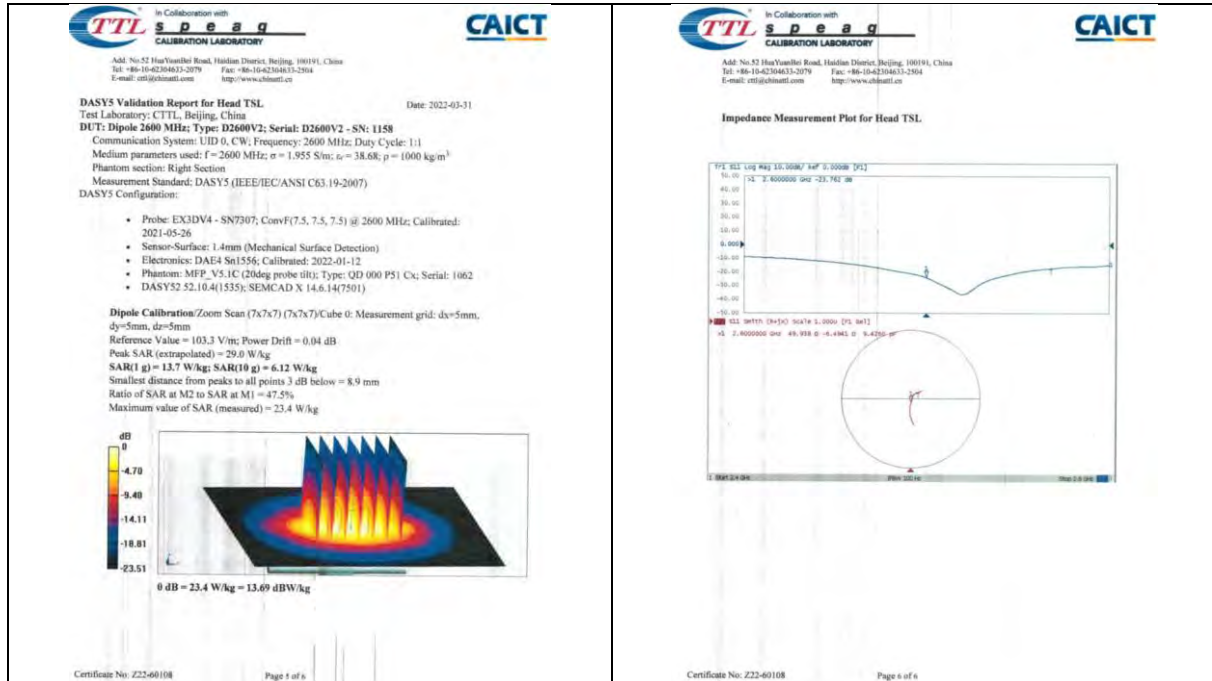


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1.12 D5GHZV2 - SN 1095

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Client: SGS-CN Certificate No: Z22-60187

CALIBRATION CERTIFICATE

Object: D5GHZV2 - SN 1095

Calibration Procedure(s): FF-Z11-003-01
Calibration Procedures for dipole validation kit

Calibration date: June 1, 2022

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (23±1)°C and humidity <70%.

Calibration Equipment used (MSTE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by: Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	24-Sep-21 (CTTL No. J21008328)	Sep-22
Power sensor NRP85	104201	24-Sep-21 (CTTL No. J21008328)	Sep-22
Reference Probe EX3DV4	SN 7464	26-Jan-22 (SPEAG No. EX3-7464, Jan22)	Jan-23
DA64	SN 1556	12-Jan-22 (CTTL-SPEAG No. Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by: Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY48071430	13-Jan-22 (CTTL No. J22000408)	Jan-23
Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL No. J22000406)	Jan-23

Calibrated by: Zhao Jing SAR Test Engineer

Reviewed by: Lin Hao SAR Test Engineer

Approved by: Qi Dianyan SAR Project Leader

Issued: June 6, 2022

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Certificate No: Z22-60187 Page 1 of 10

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Glossary:

TSL: Issue simulating liquid

CompF: sensitivity in TSL + NORM(x,y,z)

N/A: not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEC/IEEE 62209-1528, "Measurement Procedure for the Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices-Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020

b) KDB 665664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance station is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor $k=2$, which for a normal distribution Corresponds to a coverage probability of approximately 95%.

Certificate No: Z22-60187 Page 7 of 10



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Measurement Conditions SAR system configuration, as for as not given on page 1.			
DASY Version	DASY2	32.10.4	
Extrapolation	Advanced Extrapolation		
Phantom	Triple Flat Phantom S.1C		
Distance Dipole Center - TSL	10 mm	with Spacer	
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)	
Frequency	500 MHz ± 1 MHz 800 MHz ± 1 MHz 1500 MHz ± 1 MHz 5600 MHz ± 1 MHz		
Head TSL parameters at 5200MHz The following parameters and calculations were applied:			
Nominal Head TSL parameters	Temperature	Permittivity	Conductivity
	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 5 %	4.73 mho/m ± 5 %
Head TSL temperature change during test	<1.0 °C	—	—
SAR result with Head TSL at 5200MHz			
SAR averaged over 1 cm ² (1 g) of Head TSL	Condition		
SAR measured	250 mW input power	7.75 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	77.8 W/kg ± 24.4 % (k=2)	
SAR averaged over 10 cm ² (10 g) of Head TSL	Condition		
SAR measured	250 mW input power	2.22 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	22.1 W/kg ± 24.2 % (k=2)	
Head TSL parameters at 5500MHz The following parameters and calculations were applied:			
Nominal Head TSL parameters	Temperature	Permittivity	Conductivity
	22.0 °C	35.8	4.88 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.8 ± 5 %	4.84 mho/m ± 5 %
Head TSL temperature change during test	<1.0 °C	—	—
SAR result with Head TSL at 5500MHz			
SAR averaged over 1 cm ² (1 g) of Head TSL	Condition		
SAR measured	100 mW input power	8.26 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	82.5 W/kg ± 24.4 % (k=2)	
SAR averaged over 10 cm ² (10 g) of Head TSL	Condition		
SAR measured	100 mW input power	2.34 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	23.3 W/kg ± 24.2 % (k=2)	
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Head TSL parameters at 5600MHz The following parameters and calculations were applied:			
Nominal Head TSL parameters	Temperature	Permittivity	Conductivity
	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.7 ± 5 %	5.05 mho/m ± 5 %
Head TSL temperature change during test	<1.0 °C	—	—
SAR result with Head TSL at 5600MHz			
SAR averaged over 1 cm ² (1 g) of Head TSL	Condition		
SAR measured	100 mW input power	8.12 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	80.8 W/kg ± 24.4 % (k=2)	
SAR averaged over 10 cm ² (10 g) of Head TSL	Condition		
SAR measured	100 mW input power	2.30 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	22.9 W/kg ± 24.2 % (k=2)	
Head TSL parameters at 5800MHz The following parameters and calculations were applied:			
Nominal Head TSL parameters	Temperature	Permittivity	Conductivity
	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.4 ± 5 %	5.25 mho/m ± 5 %
Head TSL temperature change during test	<1.0 °C	—	—
SAR result with Head TSL at 5800MHz			
SAR averaged over 1 cm ² (1 g) of Head TSL	Condition		
SAR measured	100 mW input power	7.71 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	76.7 W/kg ± 24.4 % (k=2)	
SAR averaged over 10 cm ² (10 g) of Head TSL	Condition		
SAR measured	100 mW input power	2.16 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	21.5 W/kg ± 24.2 % (k=2)	
Certificate No: Z22-60187 Page 5 of 10			

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Appendix (Additional assessments outside the scope of CNAS L0570)			
Antenna Parameters with Head TSL at 5200MHz			
Impedance, transformed to feed point	48.10-5.03jΩ		
Return Loss	-23.8dB		
Antenna Parameters with Head TSL at 5300MHz			
Impedance, transformed to feed point	47.80-2.42jΩ		
Return Loss	-23.5dB		
Antenna Parameters with Head TSL at 5500MHz			
Impedance, transformed to feed point	50.30-4.26jΩ		
Return Loss	-27.4dB		
Antenna Parameters with Head TSL at 5600MHz			
Impedance, transformed to feed point	54.80-4.89jΩ		
Return Loss	-24.6dB		
Antenna Parameters with Head TSL at 5800MHz			
Impedance, transformed to feed point	51.50-5.61jΩ		
Return Loss	-24.9dB		
Certificate No: Z22-60187 Page 6 of 10			

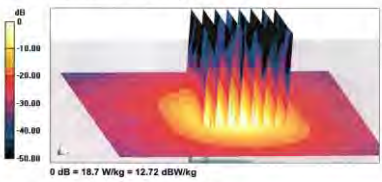
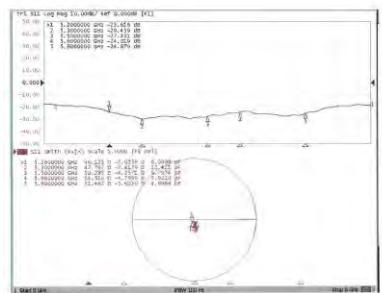


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TTL In Collaboration with CAICT CALIBRATION LABORATORY Add: No.52 Huayuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62302117 E-mail: csl@caict.ac.cn http://www.caict.ac.cn General Antenna Parameters and Design Electrical Delay (one direction): 1.021 ns After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured. The dipole is made of standard semirigid coaxial cable. The carrier conductor of the feeding line is directly connected to the second arm of the dipole. This antenna is therefore short-circuited for DC signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feed-point may be damaged. Additional EUT Data Manufactured by: SPEAG Certificate No: Z22-60187 Page 1 of 6	TTL In Collaboration with CAICT CALIBRATION LABORATORY Add: No.52 Huayuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62302117 E-mail: csl@caict.ac.cn http://www.caict.ac.cn DASY5 Validation Report for Head TSL (Date: 2022-09-01) Test Laboratory: CTTL, Beijing, China DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1095 Communication System: CW; Frequency: 5200 MHz; Frequency: 5300 MHz; Frequency: 5500 MHz; Frequency: 5600 MHz; Frequency: 5800 MHz; Duty Cycle: 1:1 Medium parameters used: $f = 5200$ MHz; $\sigma = 4.82$ S/m; $\epsilon = 35.39$; $\rho = 1000$ kg/m³ Medium parameters used: $f = 5300$ MHz; $\sigma = 4.73$ S/m; $\epsilon = 35.19$; $\rho = 1000$ kg/m³ Medium parameters used: $f = 5500$ MHz; $\sigma = 4.939$ S/m; $\epsilon = 34.83$; $\rho = 1000$ kg/m³ Medium parameters used: $f = 5600$ MHz; $\sigma = 5.051$ S/m; $\epsilon = 34.89$; $\rho = 1000$ kg/m³ Medium parameters used: $f = 5800$ MHz; $\sigma = 5.247$ S/m; $\epsilon = 34.42$; $\rho = 1000$ kg/m³ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) DASY5 Configuration: - Probe: EX3DV4 - SN7484; ConvF(5.6, 5.6, 5.6) @ 5200 MHz; ConvF(5.32, 5.32, 5.32) @ 5300 MHz; ConvF(5.11, 5.11, 5.11) @ 5500 MHz; ConvF(4.91, 4.91, 4.91) @ 5600 MHz; ConvF(5.5, 5.5, 5.5) @ 5800 MHz; Calibrated: 2022-01-28 - Sensor-Surface: 1.4mm (Mechanical Surface Detection) - Electronics: DA84 Sn1556; Calibrated: 2022-01-12 - Phantom: MPF_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062 - DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501) Dipole Calibration /Pin=100mW, d=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Reference Value = 60.80 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 29.8 W/kg SAR(1 g) = 7.73 W/kg; SAR(10 g) = 2.22 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 66.8% Maximum value of SAR (measured) = 19.3 W/kg Dipole Calibration /Pin=100mW, d=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Reference Value = 61.08 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 31.5 W/kg SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.27 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 65.5% Maximum value of SAR (measured) = 19.0 W/kg Certificate No: Z22-60187 Page 2 of 6
TTL In Collaboration with CAICT CALIBRATION LABORATORY Add: No.52 Huayuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62302117 E-mail: csl@caict.ac.cn http://www.caict.ac.cn Dipole Calibration /Pin=100mW, d=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Reference Value = 61.92 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 34.7 W/kg SAR(1 g) = 8.28 W/kg; SAR(10 g) = 2.34 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 63.9% Maximum value of SAR (measured) = 20.2 W/kg Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Reference Value = 65.08 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 35.3 W/kg SAR(1 g) = 8.12 W/kg; SAR(10 g) = 2.3 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 62.5% Maximum value of SAR (measured) = 19.1 W/kg Dipole Calibration /Pin=100mW, d=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Reference Value = 62.13 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 34.8 W/kg SAR(1 g) = 7.71 W/kg; SAR(10 g) = 2.16 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 61.6% Maximum value of SAR (measured) = 18.7 W/kg  Certificate No: Z22-60187 Page 3 of 6	TTL In Collaboration with CAICT CALIBRATION LABORATORY Add: No.52 Huayuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62302117 E-mail: csl@caict.ac.cn http://www.caict.ac.cn Impedance Measurement Plot for Head TSL  Certificate No: Z22-60187 Page 4 of 6



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2 DAE4 - SN 1245

Schmid & Partner Engineering AG Zugzwangstrasse 43, 8004 Zurich, Switzerland Phone +41 (0)43 9702, Fax +41 (0)43 9775 info@sgs.ch, info@sgs.cn s p e a g IMPORTANT NOTICE USAGE OF THE DAE4 The DAE4 unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE4. Special attention shall be given to the following points: Battery Exchange: The battery cover of the DAE4 unit is fixed using a screw, over tightening the screw may cause the threads inside the DAE4 to wear out. Shipping of the DAE4: Before shipping the DAE4 to SPEAG for calibration, remove the batteries and pack the DAE4 in an anti-static bag. This anti-static bag shall then be packed into a larger box or container which protects the DAE4 from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside. E-stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE4 carefully and keep the DAE4 unit in a non-dusty environment if not used for measurements. Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect. DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file. Important Note: Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer. Important Note: Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure. Important Note: To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE. TN_EH190306AE_DAE4.docx 07.03.2019	Calibration Laboratory of Schmid & Partner Engineering AG Zugzwangstrasse 43, 8004 Zurich, Switzerland Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates Client: SGS-CN (Auden) Certificate No.: DAE4-1245_May22 Accreditation No.: SCS 0108 CALIBRATION CERTIFICATE Object: DAE4 - SD 000 D04 BM - SN: 1245 Calibration procedure(s): QA CAL-06 v30 Calibration procedure for the data acquisition electronics (DAE) Calibration date: May 30, 2022 This calibration certificate documents the traceability to national standards, which include the physical units of measurement (SI). The measurement and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 1) °C and humidity < 70%. Calibration Equipment used (MATE critical for calibration) <table border="1"><thead><tr><th>Primary Standards</th><th>ID #</th><th>Due Date (Certificate No.)</th><th>Scheduled Calibration</th></tr></thead><tbody><tr><td>Kathrein Multimeter Type 2001</td><td>SN: 0810279</td><td>31-Aug-21 (No: 31368)</td><td>Aug-22</td></tr></tbody></table> <table border="1"><thead><tr><th>Secondary Standards</th><th>ID #</th><th>Check Date (in hours)</th><th>Scheduled Check</th></tr></thead><tbody><tr><td>Auto DAE Calibration Unit</td><td>SE LWS 053 AA 1001</td><td>24-Jan-22 (in hours check)</td><td>In house check: Jan-22</td></tr><tr><td>Calibrator New V1</td><td>SE LWS 006 AA 1002</td><td>24-Jan-22 (in hours check)</td><td>In house check: Jan-22</td></tr></tbody></table> Calibrated by: Dominique Steiner Function: Laboratory Technician Signature: <i>[Signature]</i> Approved by: (Ben Kuhn) Technical Manager Signature: <i>[Signature]</i> This calibration certificate shall not be reproduced except in full without written approval of the laboratory. Certificate No.: DAE4-1245_May22 Page 1 of 5	Primary Standards	ID #	Due Date (Certificate No.)	Scheduled Calibration	Kathrein Multimeter Type 2001	SN: 0810279	31-Aug-21 (No: 31368)	Aug-22	Secondary Standards	ID #	Check Date (in hours)	Scheduled Check	Auto DAE Calibration Unit	SE LWS 053 AA 1001	24-Jan-22 (in hours check)	In house check: Jan-22	Calibrator New V1	SE LWS 006 AA 1002	24-Jan-22 (in hours check)	In house check: Jan-22
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Calibration Laboratory of Schmid & Partner Engineering AG Zugzwangstrasse 43, 8004 Zurich, Switzerland Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates Accreditation No.: SCS 0108 Glossary DAE: data acquisition electronics Connector angle: information used in DASY system to align probe sensor X to the robot coordinate system. Methods Applied and Interpretation of Parameters • DC Voltage Measurement: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range. • Connector angle: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required. • The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty. • DC Voltage Measurement Linearity: Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement. • Common mode sensitivity: Influence of a positive or negative common mode voltage on the differential measurement. • Channel separation: Influence of a voltage on the neighbor channels not subject to an input voltage. • AD Converter Values with inputs shorted: Values on the internal AD converter corresponding to zero input voltage. • Input Offset Measurement: Output voltage and statistical results over a large number of zero voltage measurements. • Input Offset Current: Typical value for information; Maximum channel input offset current, not considering the input resistance. • Input resistance: Typical value for information; DAE input resistance at the connector, during internal auto-zeroing and during measurement. • Low Battery Alarm Voltage: Typical value for information. Below this voltage, a battery alarm signal is generated. • Power consumption: Typical value for information. Supply currents in various operating modes. Certificate No.: DAE4-1245_May22 Page 2 of 5	DC Voltage Measurement AD - Converter Resolution nominal High Range: 1LSB = 6.1 μV, full range = -190...+320 mV Low Range: 1LSB = 61 μV, full range = -1...+32 mV DASY measurement parameters: Auto Zero-Time: 3 sec; Measuring time: 3 sec <table border="1"><thead><tr><th>Calibration Factors</th><th>X</th><th>Y</th><th>Z</th></tr></thead><tbody><tr><td>High Range</td><td>405.265 ± 0.02% (k=2)</td><td>403.974 ± 0.02% (k=2)</td><td>406.092 ± 0.02% (k=2)</td></tr><tr><td>Low Range</td><td>3.99534 ± 1.50% (k=2)</td><td>3.99508 ± 1.50% (k=2)</td><td>4.01015 ± 1.50% (k=2)</td></tr></tbody></table> Connector Angle <table border="1"><thead><tr><th>Connector Angle to be used in DASY system</th><th>30.0° ± 1°</th></tr></thead></table> Certificate No.: DAE4-1245_May22 Page 3 of 5	Calibration Factors	X	Y	Z	High Range	405.265 ± 0.02% (k=2)	403.974 ± 0.02% (k=2)	406.092 ± 0.02% (k=2)	Low Range	3.99534 ± 1.50% (k=2)	3.99508 ± 1.50% (k=2)	4.01015 ± 1.50% (k=2)	Connector Angle to be used in DASY system	30.0° ± 1°						
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Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	19994.45	1.52	0.00
Channel X - Input	20004.58	2.22	0.01
Channel X + Input	-20000.14	1.12	-0.01
Channel Y + Input	19994.72	1.58	0.00
Channel Y - Input	20001.22	-1.00	-0.00
Channel Y + Input	-20003.05	1.57	0.01
Channel Z + Input	19992.44	0.19	0.00
Channel Z - Input	20003.09	0.58	0.00
Channel Z + Input	-20001.73	-0.27	0.00

Low Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	2001.91	0.41	0.02
Channel X - Input	2002.54	0.65	0.32
Channel X + Input	-197.86	0.07	-0.04
Channel Y + Input	2002.05	0.58	0.03
Channel Y - Input	201.27	-0.67	-0.28
Channel Y + Input	-196.23	-0.06	0.03
Channel Z + Input	2001.96	0.08	0.00
Channel Z - Input	200.09	-1.03	-0.76
Channel Z + Input	-199.85	-1.57	0.79

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (µV)	Low Range Average Reading (µV)
Channel X	200	-5.87	-7.69
	-200	9.12	7.79
Channel Y	200	-8.68	-9.28
	-200	8.52	6.36
Channel Z	200	-5.36	-5.60
	-200	3.58	3.08

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	-	4.07	-3.14
Channel Y	200	9.36	-	4.07
Channel Z	200	10.11	7.14	-

Certificate No: DAE4-1245_May22

Page 4 of 5

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15984	17040
Channel Y	16562	16768
Channel Z	16035	15968

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input (mV)	Average (µV)	min. Offset (µV)	max. Offset (µV)	Std. Deviation (µV)
Channel X	1.00	-0.15	1.93	0.45
Channel Y	-0.18	-1.28	0.94	0.45
Channel Z	-0.58	-2.81	0.58	0.60

6. Input Offset Current

Nominal input circuitry offset current on all channels: <25nA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+8	+14
Supply (- Vcc)	-0.01	-8	-9

Certificate No: DAE4-1245_May22

Page 5 of 5

3 EX3DV4 - SN 7346

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Client: **Auden** Certificate No: **EX3-7346_May22**

Accreditation No.: SCS 0108

Calibration Certificate

Object: **EX3DV4 - SN 7346**

Calibration procedure: **QA CAL-01 v6, QA CAL-14 v6, QA CAL-23 v5, QA CAL-25 v7**
Calibration procedure for domestic E-field probes

Calibration date: **March 30, 2022**

This calibration certificate documents the traceability to national standards, which requires the physical units of measurement (SI). The measurement and the uncertainty with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility, environment temperature (22 ± 0.5 °C) and humidity < 70%.

Calibration Equipment used (MPE: usual for calibration):

Primary Standards	SI	Cal Date (Certificate No.)	Scheduled Calibration
Power meter MPE	86, 10479	08-Apr-21 (No. 217-0251-0303)	Apr-22
Power sensor MPE-291	86, 10304	08-Apr-21 (No. 217-0251-0303)	Apr-22
Power sensor MPE-291	86, 10304	08-Apr-21 (No. 217-0251-0303)	Apr-22
Reference DUT attenuator	86, 10304 (20)	08-Apr-21 (No. 217-0251-0303)	Apr-22
DUT	86, 10304	13-Dec-21 (No. DAE4-1245_May22)	Dec-22
Reference Probe (S202)	86, 3013	27-Dec-21 (No. 033-0013-0001)	Dec-22

Secondary Standards

SI	Check Date (in house)	Scheduled Date
Power meter E4138	08-Apr-21 (in house check Jan-22)	In house check Jan-22
Power meter E4138A	08-Apr-21 (in house check Jan-22)	In house check Jan-22
Power sensor E4138A	08-Apr-21 (in house check Jan-22)	In house check Jan-22
Power sensor E4138A	08-Apr-21 (in house check Jan-22)	In house check Jan-22
RF generator HP 8446C	08-Apr-21 (in house check Jan-22)	In house check Jan-22
Network Analyzer B 8700A	08-Apr-21 (in house check Jan-22)	In house check Jan-22

Calibrated by: **Heidi Schmid** Function: **Laboratory Technician** Signature: *[Signature]*

Approved by: **Oliver Koller** Function: **Quality Manager** Signature: *[Signature]*

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Certificate No: EX3-7346_May22 Page 1 of 24

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Client: **Auden** Certificate No: **EX3-7346_May22**

Accreditation No.: SCS 0108

Glossary:

- TSL: Issue simulating liquid
- NORM(x,y,z): sensitivity in free space
- Comp: sensitivity in TSL / NORM(x,y,z)
- DCP: code compression point
- CF: crest factor (10/10, cycle) of the RF signal
- A, B, C, D: modulation dependent measurement parameters
- Polarization (α): α rotation around probe axis
- Polarization (β): β rotation around probe axis
- Information used in DASY system to align probe sensor X to the robot coordinate system.

Connector Angle

Calibration is Performed According to the Following Standards:

- IEC 61010-1:2011, Measurement Procedure for the Assessment of Specific Absorption Rate (SAR) of Human Exposure to Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices, Part 1:301: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz); October 2020
- ISO 9001:2015, "SAE Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM(x,y,z): Assessed for E-field polarization: $\alpha = 0$ (if $\alpha = 900$ MHz in TEM-cell: $\alpha = 900$ MHz R22 waveguide). NORM(x,y,z) are only intermediate values, i.e., the uncertainties of NORM(x,y,z) does not affect the E-field uncertainty mode TSL (see below Comp).
- NORM(x,y,z) = NORM(x,y,z) * Frequency response (see Frequency Response Chart). The uncertainty of the frequency response is included in the stated uncertainty of Comp.
- DCP(x,y,z): DCP is a numerical parameter assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAC: PAC is the Peak to Average Ratio that is not calculated but determined based on the signal characteristics.
- A(x,y,z), B(x,y,z), C(x,y,z), D(x,y,z), V(x,y,z), A, B, C, D are numerical measurement parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. V(x,y,z) is the maximum calibration range assessed in RMS voltage across the probe.
- Comp and Boundary Effect Parameters: Assessed in the probe using E-field (or Temperature Transfer Standard for $f < 400$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 400$ MHz. The same values are used for assessment of the parameters applied by boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are NORM(x,y,z) * Comp. The uncertainty of NORM(x,y,z) is not given for Comp. A frequency dependent Comp is used in DASY version 4.4 and higher which allows assessing the validity from ≈ 50 MHz to ≈ 100 MHz.
- Sensor offset (3D position) is assessed in a field of low gradients instead using a flat phantom exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (see probe axis). No tolerance required.
- Connector Angle: The angle is assessed using the information given by determining the NORM(x,y,z) uncertainty required.

Certificate No: EX3-7346_May22 Page 2 of 24



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EX3DV4 - SN:7346										March 30, 2022									
DASY/EASY - Parameters of Probe: EX3DV4 - SN:7346										DASY/EASY - Parameters of Probe: EX3DV4 - SN:7346									
Basic Calibration Parameters										Sensor Model Parameters									
Norm. $\Delta V/V$ (mV/V) ¹										C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16									
DOP (mV/V) ²										ms.V ¹ ms.V ¹ ms.V ¹ ms.V ¹ ms.V ¹ ms.V ¹ ms.V ¹ ms.V ¹ ms.V ¹ ms.V ¹ ms.V ¹ ms.V ¹ ms.V ¹ ms.V ¹ ms.V ¹									
101.4 0.45 0.47 0.61 0.10 ± 10.1%										X 39.2 291.80 35.10 5.63 0.33 5.02 1.42 0.12 1.01 37.1 270.84 34.12 8.29 0.00 5.01 1.82 0.05 1.01 9.7 69.74 33.37 4.96 0.00 4.94 0.61 0.00 1.00									
Calibration Results for Modulation Response										Other Probe Parameters									
UID Communication System Name A dB B dB-μV C dB D dB VR mV Max dBm Max (dBm)										Sensor Arrangement Triangular									
T1 C1V X 0.00 0.00 0.00 0.00 0.00 143.8 ± 5.0%										Connector Angle (°) -166.1									
T2005 AAA X 0.00 0.00 0.00 0.00 0.00 139.3										Mechanical Surface Detection Mode enabled									
T1005 AAA X 0.00 0.00 0.00 0.00 0.00 139.3										Optical Surface Detection Mode disabled									
T1005 AAA X 0.00 0.00 0.00 0.00 0.00 139.3										Probe Overall Length 237 mm									
T1005 AAA X 0.00 0.00 0.00 0.00 0.00 139.3										Probe Body Diameter 9 mm									
T1005 AAA X 0.00 0.00 0.00 0.00 0.00 139.3										Tip Length 2.5 mm									
T1005 AAA X 0.00 0.00 0.00 0.00 0.00 139.3										Tip Diameter 1 mm									
T1005 AAA X 0.00 0.00 0.00 0.00 0.00 139.3										Probe Tip to Sensor X Calibration Point 1 mm									
T1005 AAA X 0.00 0.00 0.00 0.00 0.00 139.3										Probe Tip to Sensor Y Calibration Point 1 mm									
T1005 AAA X 0.00 0.00 0.00 0.00 0.00 139.3										Probe Tip to Sensor Z Calibration Point 1 mm									
T1005 AAA X 0.00 0.00 0.00 0.00 0.00 139.3										Recommended Measurement Distance from Surface 1.4 mm									
Note: For details on UID parameters see Appendix										Note: Measurement distance from surface can be increased to 3.4 mm for an Area Scan job.									
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.																			
Certificate No: EX3-7346_Mar22										Certificate No: EX3-7346_Mar22									

EX3DV4 - SN:7346										March 30, 2022									
DASY/EASY - Parameters of Probe: EX3DV4 - SN:7346										DASY/EASY - Parameters of Probe: EX3DV4 - SN:7346									
Calibration Parameter Determined in Head Tissue Simulating Media										Calibration Parameter Determined in Head Tissue Simulating Media									
f (MHz) Relative Permittivity ¹ Conductivity (S/m) ² CoreF X CoreF Y CoreF Z Alpha ³ Depth (mm) Unc. (k=2)										f (MHz) Relative Permittivity ¹ Conductivity (S/m) ² CoreF X CoreF Y CoreF Z Alpha ³ Depth (mm) Unc. (k=2)									
750 41.9 0.89 10.56 10.56 10.56 0.55 0.85 ± 12.0%										6500 34.5 6.07 5.30 5.30 5.30 0.20 2.50 ± 18.0%									
835 41.5 0.90 10.12 10.12 10.12 0.42 0.96 ± 12.0%																			
900 41.5 0.97 10.10 10.10 10.10 0.53 0.80 ± 12.0%																			
1450 40.5 1.20 9.26 9.26 9.26 0.50 0.80 ± 12.0%																			
1750 40.1 1.37 8.83 8.83 8.83 0.34 0.86 ± 12.0%																			
1900 40.0 1.40 8.48 8.48 8.48 0.35 0.86 ± 12.0%																			
2000 40.0 1.40 8.35 8.35 8.35 0.34 0.86 ± 12.0%																			
2300 39.5 1.67 7.86 7.86 7.86 0.39 0.90 ± 12.0%																			
2450 39.2 1.80 7.63 7.63 7.63 0.41 0.90 ± 12.0%																			
2600 39.0 1.96 7.33 7.33 7.33 0.44 0.90 ± 12.0%																			
3300 38.2 2.71 7.15 7.15 7.15 0.30 1.35 ± 13.1%																			
3500 37.8 2.81 7.14 7.14 7.14 0.30 1.35 ± 13.1%																			
3750 37.7 3.12 6.85 6.85 6.85 0.30 1.35 ± 13.1%																			
3900 37.5 3.32 6.71 6.71 6.71 0.40 1.60 ± 13.1%																			
4100 37.2 3.53 6.58 6.58 6.58 0.40 1.60 ± 13.1%																			
4200 37.1 3.63 6.30 6.30 6.30 0.40 1.70 ± 13.1%																			
4400 36.9 3.84 6.24 6.24 6.24 0.40 1.70 ± 13.1%																			
4600 36.7 4.04 6.11 6.11 6.11 0.40 1.70 ± 13.1%																			
4800 36.4 4.25 5.98 5.98 5.98 0.40 1.80 ± 13.1%																			
4900 36.3 4.40 5.84 5.84 5.84 0.40 1.80 ± 13.1%																			
5200 36.0 4.66 5.25 5.25 5.25 0.40 1.80 ± 13.1%																			
5300 35.9 4.78 5.12 5.12 5.12 0.40 1.80 ± 13.1%																			
5500 35.6 4.96 4.85 4.85 4.85 0.40 1.80 ± 13.1%																			
5600 35.5 5.07 4.70 4.70 4.70 0.40 1.80 ± 13.1%																			
5800 35.3 5.27 4.75 4.75 4.75 0.40 1.80 ± 13.1%																			
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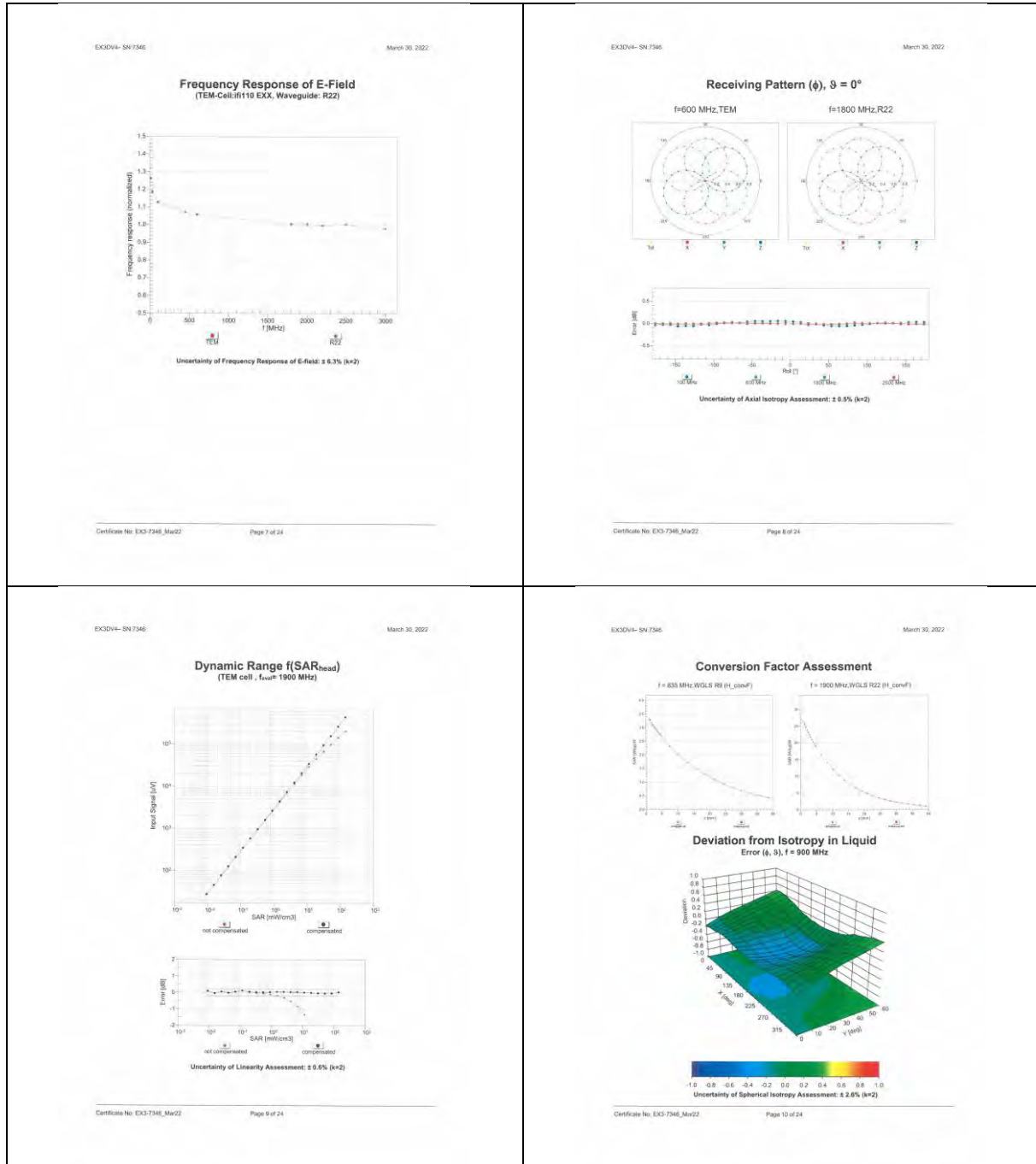


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EX3034-SN-7346				March 30, 2022			
10414	AAA	WLAN CDF4 64-QAMx	Generic	8.54	± 0.6 %		
10415	AAA	IEEE 802.11b WFI 2.4 GHz (DSSS, 1 Mbps, R90c-d)	WLAN	1.54	± 0.6 %		
10416	AAA	IEEE 802.11g WFI 2.4 GHz (DSSS-OFDM, 5.5 Mbps, R90c-d)	WLAN	8.23	± 0.6 %		
10417	AAC	IEEE 802.11n WFI 5 GHz (OFDM, 6 Mbps, R90c-d)	WLAN	8.23	± 0.6 %		
10418	AAA	IEEE 802.11g WFI 2.4 GHz (DSSS-OFDM, 5.5 Mbps, R90c-d)	WLAN	8.14	± 0.6 %		
10419	AAA	IEEE 802.11g WFI 2.4 GHz (DSSS-OFDM, 6 Mbps, R90c-d)	WLAN	8.19	± 0.6 %		
10420	AAC	IEEE 802.11n HT Overhead, 7.2 Mbps, R90c-d	WLAN	8.32	± 0.6 %		
10421	AAC	IEEE 802.11n HT Overhead, 6.3 Mbps, 16-QAM	WLAN	8.47	± 0.6 %		
10424	AAC	IEEE 802.11n HT Overhead, 7.2 Mbps, 64-QAM	WLAN	8.40	± 0.6 %		
10425	AAC	IEEE 802.11n HT Overhead, 14 Mbps, R90c-d	WLAN	8.41	± 0.6 %		
10426	AAC	IEEE 802.11n HT Overhead, 30 Mbps, 16-QAM	WLAN	8.45	± 0.6 %		
10427	AAC	IEEE 802.11n HT Overhead, 130 Mbps, 64-QAM	WLAN	8.41	± 0.6 %		
10430	AAD	LTE-FDD OFDMA, 5 MHz, E-TRP 3.1	LTE-FDD	8.28	± 0.6 %		
10431	AAD	LTE-FDD OFDMA, 10 MHz, E-TRP 3.1	LTE-FDD	8.38	± 0.6 %		
10432	AAC	LTE-FDD OFDMA, 15 MHz, E-TRP 3.1	LTE-FDD	8.34	± 0.6 %		
10433	AAC	LTE-FDD OFDMA, 20 MHz, E-TRP 3.1	LTE-FDD	8.34	± 0.6 %		
10434	AAA	WCDMA (BS Test Model 1, 64 DPCCH)	WCDMA	8.60	± 0.6 %		
10435	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10447	AAD	LTE-FDD OFDMA, 5 MHz, E-TRP 3.1, Clipping 44%	LTE-FDD	7.96	± 0.6 %		
10448	AAD	LTE-FDD OFDMA, 10 MHz, E-TRP 3.1, Clipping 44%	LTE-FDD	7.93	± 0.6 %		
10449	AAC	LTE-FDD OFDMA, 15 MHz, E-TRP 3.1, Clipping 44%	LTE-FDD	7.91	± 0.6 %		
10450	AAC	LTE-FDD OFDMA, 20 MHz, E-TRP 3.1, Clipping 44%	LTE-FDD	7.88	± 0.6 %		
10451	AAA	WCDMA (BS Test Model 1, 64 DPCCH, Clipping 44%)	WCDMA	7.89	± 0.6 %		
10452	AAD	Validation (Spurious, 10ms, 1ms)	Test	10.00	± 0.6 %		
10456	AAC	IEEE 802.11ac WFI (160MHz, 64-QAM, R90c-d)	WLAN	8.63	± 0.6 %		
10457	AAA	UMTS FDD (SC-HSPA)	WCDMA	6.62	± 0.6 %		
10458	AAA	CDMA2000 (1xEV-DO, Rev. 8, 3.1c)	CDMA2000	8.58	± 0.6 %		
10459	AAA	CDMA2000 (1xEV-DO, Rev. 8, 3.1c)	CDMA2000	8.25	± 0.6 %		
10460	AAA	UMTS FDD (HSPA, R90c-d)	WCDMA	2.39	± 0.6 %		
10461	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10462	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Sub)	LTE-TDD	8.30	± 0.6 %		
10463	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM, UL Sub)	LTE-TDD	8.30	± 0.6 %		
10464	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10465	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10466	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10467	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10468	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10469	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10470	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10471	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10472	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10473	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10474	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10475	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10476	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10477	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10478	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10479	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10480	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10481	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10482	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10483	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10484	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 64-QAM, UL Sub)	LTE-TDD	8.47	± 0.6 %		
10485	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10486	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10487	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10488	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
Certificate No. EX3-7346_Mar22				Page 15 of 24			
EX3034-SN-7346				March 30, 2022			
10489	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10490	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10491	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10492	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10493	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10494	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10495	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10496	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10497	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10498	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10499	AAB	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10500	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10501	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10502	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10503	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10504	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10505	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10506	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10507	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10508	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10509	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10510	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10511	AAC	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10512	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 0.6 %		
10513	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10514	AAF	LTE-TDD (SC-FDMA, 1 RB, 3.1 MHz, 64-QAM, UL Sub)	LTE-TDD	8.32	± 0.6 %		
10515	AAA	IEEE 802.11b WFI 2.4 GHz (DSSS, 1 Mbps, R90c-d)	WLAN	1.58	± 0.6 %		
10516	AAA	IEEE 802.11b WFI 2.4 GHz (DSSS, 5.5 Mbps, R90c-d)	WLAN	1.57	± 0.6 %		
10517	AAA	IEEE 802.11g WFI 2.4 GHz (DSSS, 11 Mbps, R90c-d)	WLAN	1.58	± 0.6 %		
10518	AAC	IEEE 802.11n WFI 5 GHz (OFDM, 6 Mbps, R90c-d)	WLAN	8.23	± 0.6 %		
10519	AAC	IEEE 802.11n WFI 5 GHz (OFDM, 12 Mbps, R90c-d)	WLAN	8.39	± 0.6 %		
10520	AAC	IEEE 802.11n WFI 5 GHz (OFDM, 18 Mbps, R90c-d)	WLAN	8.12	± 0.6 %		
10521	AAC	IEEE 802.11n WFI 5 GHz (OFDM, 24 Mbps, R90c-d)	WLAN	7.97	± 0.6 %		
10522	AAC	IEEE 802.11n WFI 5 GHz (OFDM, 36 Mbps, R90c-d)	WLAN	8.45	± 0.6 %		
10523	AAC	IEEE 802.11n WFI 5 GHz (OFDM, 48 Mbps, R90c-d)	WLAN	8.48	± 0.6 %		
10524	AAC	IEEE 802.11n WFI 5 GHz (OFDM, 54 Mbps, R90c-d)	WLAN	8.27	± 0.6 %		
10525	AAC	IEEE 802.11ac WFI (20MHz, MCS9, R90c-d)	WLAN	8.36	± 0.6 %		
10526	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.42	± 0.6 %		
10527	AAC	IEEE 802.11ac WFI (20MHz, MCS3, R90c-d)	WLAN	8.21	± 0.6 %		
10528	AAC	IEEE 802.11ac WFI (20MHz, MCS5, R90c-d)	WLAN	8.39	± 0.6 %		
10529	AAC	IEEE 802.11ac WFI (20MHz, MCS7, R90c-d)	WLAN	8.36	± 0.6 %		
10530	AAC	IEEE 802.11ac WFI (20MHz, MCS9, R90c-d)	WLAN	8.29	± 0.6 %		
10531	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.39	± 0.6 %		
10532	AAC	IEEE 802.11ac WFI (20MHz, MCS3, R90c-d)	WLAN	8.29	± 0.6 %		
10533	AAC	IEEE 802.11ac WFI (20MHz, MCS5, R90c-d)	WLAN	8.30	± 0.6 %		
10534	AAC	IEEE 802.11ac WFI (20MHz, MCS7, R90c-d)	WLAN	8.45	± 0.6 %		
10535	AAC	IEEE 802.11ac WFI (20MHz, MCS9, R90c-d)	WLAN	8.45	± 0.6 %		
10536	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.32	± 0.6 %		
10537	AAC	IEEE 802.11ac WFI (20MHz, MCS3, R90c-d)	WLAN	8.44	± 0.6 %		
10538	AAC	IEEE 802.11ac WFI (20MHz, MCS5, R90c-d)	WLAN	8.34	± 0.6 %		
10539	AAC	IEEE 802.11ac WFI (20MHz, MCS7, R90c-d)	WLAN	8.39	± 0.6 %		
10540	AAC	IEEE 802.11ac WFI (20MHz, MCS9, R90c-d)	WLAN	8.39	± 0.6 %		
10541	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.46	± 0.6 %		
10542	AAC	IEEE 802.11ac WFI (20MHz, MCS3, R90c-d)	WLAN	8.45	± 0.6 %		
10543	AAC	IEEE 802.11ac WFI (20MHz, MCS5, R90c-d)	WLAN	8.45	± 0.6 %		
10544	AAC	IEEE 802.11ac WFI (20MHz, MCS7, R90c-d)	WLAN	8.47	± 0.6 %		
10545	AAC	IEEE 802.11ac WFI (20MHz, MCS9, R90c-d)	WLAN	8.55	± 0.6 %		
10546	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.35	± 0.6 %		
Certificate No. EX3-7346_Mar22				Page 16 of 24			
EX3034-SN-7346				March 30, 2022			
10547	AAC	IEEE 802.11ac WFI (20MHz, MCS3, R90c-d)	WLAN	8.49	± 0.6 %		
10548	AAC	IEEE 802.11ac WFI (20MHz, MCS5, R90c-d)	WLAN	8.37	± 0.6 %		
10549	AAC	IEEE 802.11ac WFI (20MHz, MCS7, R90c-d)	WLAN	8.39	± 0.6 %		
10550	AAC	IEEE 802.11ac WFI (20MHz, MCS9, R90c-d)	WLAN	8.39	± 0.6 %		
10551	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.37	± 0.6 %		
10552	AAC	IEEE 802.11ac WFI (20MHz, MCS3, R90c-d)	WLAN	8.42	± 0.6 %		
10553	AAC	IEEE 802.11ac WFI (20MHz, MCS5, R90c-d)	WLAN	8.48	± 0.6 %		
10554	AAC	IEEE 802.11ac WFI (20MHz, MCS7, R90c-d)	WLAN	8.48	± 0.6 %		
10555	AAC	IEEE 802.11ac WFI (20MHz, MCS9, R90c-d)	WLAN	8.47	± 0.6 %		
10556	AAC	IEEE 802.11ac WFI (20MHz, MCS1, R90c-d)	WLAN	8.47	± 0.6 %		
10557	AAC	IEEE 802.11ac WFI (20MHz, MCS3, R90c-d)	WLAN	8.52	± 0.6 %	</	


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EXCIV4-SN 7346 March 30, 2022 15985 AAA 50 NR DL (CP-CFOM, TM 3.1, 40 MHz, 64-QAM, 30 kHz) 50 NR PR1 TDD 9.54 ± 9.8 % 15986 AAA 50 NR DL (CP-CFOM, TM 3.1, 50 MHz, 64-QAM, 30 kHz) 50 NR PR1 TDD 9.50 ± 9.8 % 15987 AAA 50 NR DL (CP-CFOM, TM 3.1, 60 MHz, 64-QAM, 30 kHz) 50 NR PR1 TDD 9.50 ± 9.8 % 15988 AAA 50 NR DL (CP-CFOM, TM 3.1, 70 MHz, 64-QAM, 30 kHz) 50 NR PR1 TDD 9.38 ± 9.8 % 15989 AAA 50 NR DL (CP-CFOM, TM 3.1, 80 MHz, 64-QAM, 30 kHz) 50 NR PR1 TDD 9.51 ± 9.8 % 15990 AAA 50 NR DL (CP-CFOM, TM 3.1, 90 MHz, 64-QAM, 30 kHz) 50 NR PR1 TDD 9.52 ± 9.8 % ¹ Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value. Certificate No. EXC-7346_Mar22 Page 24 of 24	EXCIV4-SN 7346 March 30, 2022 15985 AAA 50 NR DL (CP-CFOM, TM 3.1, 40 MHz, 64-QAM, 30 kHz) 50 NR PR1 TDD 9.54 ± 9.8 % 15986 AAA 50 NR DL (CP-CFOM, TM 3.1, 50 MHz, 64-QAM, 30 kHz) 50 NR PR1 TDD 9.50 ± 9.8 % 15987 AAA 50 NR DL (CP-CFOM, TM 3.1, 60 MHz, 64-QAM, 30 kHz) 50 NR PR1 TDD 9.50 ± 9.8 % 15988 AAA 50 NR DL (CP-CFOM, TM 3.1, 70 MHz, 64-QAM, 30 kHz) 50 NR PR1 TDD 9.38 ± 9.8 % 15989 AAA 50 NR DL (CP-CFOM, TM 3.1, 80 MHz, 64-QAM, 30 kHz) 50 NR PR1 TDD 9.51 ± 9.8 % 15990 AAA 50 NR DL (CP-CFOM, TM 3.1, 90 MHz, 64-QAM, 30 kHz) 50 NR PR1 TDD 9.52 ± 9.8 % ¹ Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value. Certificate No. EXC-7346_Mar22 Page 24 of 24
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4 Impedance and return loss

Dipole CLA150 SN 4025				
Head Liquid				
Date of Measurement	Return Loss(dB)	Δ %	Impedance (Ω)	ΔΩ
2021/4/26	-31.4	/	47.8	/
Dipole D450V3 SN 1103				
Head Liquid				
Date of Measurement	Return Loss(dB)	Δ %	Impedance (Ω)	ΔΩ
2021/4/21	-23	/	57.1	/



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